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THE

CHEMICAL TIMES,

AND

JOURNAL OF PHARMACY,

MANUFACTURES, AGRICULTURE, AND THE INDUSTRIAL ARTS.

VOLUME THE FOURTH.

NOVEMBER 11, 1848, TO MAY 5, 1849.

LONDON:

PUBLISHED BY ROBERT PALMER, 320, STRAND.

MDCCCXLIX.

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ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By Dr. SCOFFERN.

The substance sugar,* which has been so long and largely used among all nations of the civilized world, and many of the barbarous ones, that it is now considered one of the necessities of life, appears to have been totally unknown not only to the ancient Greeks and Romans, but also to the Oriental nations with which the former were in communication. Of all Eastern products, indeed, sugar appears to have been the latest known. The chronicles of ancient Egypt, Phœnicia, and India make no mention of it; and it did not find its way into Arabia as a commercial article until the eleventh century, soon after which period some adventurous Venetian travellers achieved the introduction of the substance as a commercial article into their native city, where the first sugar-refiners were established, and whence the taste for sugar was widely disseminated.

Even as regards the sugar-cane the testimony of ancient authors is exceedingly devoid of precision. The most ancient author who mentions the sugar-cane is Theophrastus (B.C. 321), who in his chapter on honey states that "the generation of honey is threefold: the first is from flowers or other things in which there is sweetness; the second from the air, which, when there are dews, is concocted by the heat of the sun, and falls, particularly in harvest time; the third sort is from canes or reeds.†

Theophrastus in another place‡ mentions a sort of reed or cane growing in marshy situations in Egypt with sweet roots. The passage has been understood by many persons to refer to the sugar-cane, but many reasons may be adduced in opposition to this opinion. In the first place the sugar-cane is not an aquatic plant, and also its roots are not so sweet as its stem. Moreover, if it really had existed in Egypt, there were those who certainly would have chronicled the circumstance with more precision than we find in the above vague expression of Theophrastus.

If we are to credit the testimony of Strabo, in his history of India, written about the nineteenth year of the Christian era, Nearchus, the admiral of Alexander the Great, about 300 B.C., not only saw the sugar-cane in India, but was aware that a substance resembling honey (sugar) could be extracted from it. But, if this statement were true, the sugar-cane would seem to have remained very uncommon in India, and sugar still more so, seeing that Seneca and Lucan, who lived in the time of Nero, A.D. 62, alluded to the sugar-cane and to sugar in language so ambiguous and obscure, that some have even doubted whether another plant and another substance might not have been intended.

Seneca, in his 84th epistle, has the following passage:—

"Aiunt inveniri apud Indos mel in harundinarum foliis quod aut ros illius cœli aut ipsius harundinis humor dulcis et pinguior gignat. In nostris quoque herbis vim eandam sed minus manifestam et notabilem poni quam prosequatur et contrahat animal huic rei genitum."

Lucan,§ speaking of the Indians near the Ganges, writes:—

"Quique bibunt tenera dulces ab arundine succos."

Pliny is the next author of repute who mentions the sugar-cane. This was about the year 78 A.D., after which period such little testimony on the point as exists is far too vague and unsatisfactory to occupy our attention.

The dark ages now rapidly approached, and during two thirds of that long and melancholy period we may be warranted in assuming that no European information was acquired relative to the natural history of the cane or the properties of sugar.

To the crusades we probably are indebted for disseminating in Europe, about the latter third of the dark ages, such a knowledge of the sugar-cane and its extracts as caused the speedy introduction of both into this quarter of the globe. The sturdy warriors of the cross, on their return to the West, began to long for many Oriental luxuries for which they had acquired a taste. An Oriental commerce was speedily established, and Venice became the great emporium of the riches of the East, and amongst them sugar, as I have already observed.

Between the twelfth and fifteenth centuries the sugar-cane was cultivated in Sicily, the south of Spain, and, indeed, many other Mediterranean regions. In the south of France the culture was tried, but without success, the climate proving too cold for so tender a plant. In the Canary Isles the cane was, however, most productive, and supplied Europe with a great amount of saccharine produce, until the discovery of the West India Islands by the Spaniards in 1492; and the maritime discovery of India by the Portuguese opened newer and more congenial soils to the production of the tender crop. Much controvery has existed as to whether the sugar-cane was indigenous to the New World or not. At this period it would be impossible to determine this point, so much has the subject been involved by lapse of time and incapacity of earlier historians. Fortunately the matter is in practice of no importance whatever. Suffice it to know that the West India Islands, almost immediately subsequent to their discovery, began to supply civilized Europe with large quantities of sugar, and the less fertile fields of Southern Europe soon fell into desuetude.

The object of these papers being to describe the manufacture of sugar generally, the field when contemplated is large and important. Scarcely any two nations manufacture sugar precisely alike, and even for the same people the variations of treatment are numerous and important. Such of these processes as may be deemed of practical value will be hereafter given in detail; but preparatory to this information it will be desirable to direct a cursory glance at the nature and composition of the sugar-cane, and to learn the theoretic indications which science prompts an intelligent sugar-manufacturer to carry out. This information being supplied and studied in connection with each several process, the reader will easily see whenever a principle is violated or an indication unfulfilled.

The sugar-cane is a gigantic grass, belonging to that grand class of vegetables which derive an increase of structure by internal woody deposits, and hence called by botanists *Endogenous*.

Like all other grasses, it is possessed of an external coating of silica or flint, and internally it is made up of a congeries of cells. One portion of those cells contains sugar almost in a state of pure aqueous solution; another portion contains various albuminous and other organic matters, both nitrogenized and unnitrogenized. There are, besides, present several but variable metallic salts and green colouring matter, called by chemists chlorophylle.

The above is not to be considered in the light of a precise chemical statement of the composition of the cane, but as merely an indication, quite sufficient for all practical purposes.

The usual, and, indeed, the only hitherto *practical*, means of obtaining the saccharine liquid of cane is by expression, that is to say, the green canes being exposed to the compression of a series of iron cylinders (the sugar-mill), their juice is more or less completely expressed. Other means than crushing have been devised, but they are difficult of execution on the large scale: they are, most probably, impracticable. Hereafter I shall have to describe them in full, but at present our attention will be confined to the juice of expression.

Now, it is evident that such juice will not merely consist of the aqueous solution of sugar contained in the sugar cells, but that it will be a mixture of all the expressible matters existing in the cane. Here is the source of all difficulty.

It is a fact well known to chemists that, as a general rule, crystallizable substances refuse to crystallize out of solutions which contain much vegetable impurity.

Thus, the juice of limes and lemons contains a large amount of citric acid, a substance easily crystallized under proper circumstances, but which refuses to crystallize out of crude lemon-juice. Immediately, however, that the mucilaginous, albuminous, and other vegetable impurities have been by adequate means,—unnecessary here to describe,—removed, then the citric acid is crystallized without any difficulty.

A multitude of similar instances might be cited were they necessary, but the fact, being universal, may be summarily dismissed.

Inasmuch as sugar is a crystallizable substance, and that habit requires it to be in a crystallized state, the first indication to be followed out is *to remove all foreign, especially vegetable, impurities from the compound juice.*

Sugar-manufacturers, however much they may vary in opinion on other points, at least agree in this.

The means of effecting this removal is a proposition to be hereafter discussed.

Lucian affirmed that "*the beginning was the half of all.*" The beginning (the proper beginning is here understood) of the sugar manufacture is certainly nine tenths of all; so little comparativcly remains to be accomplished if only the juice have been at the outset rendered pure.

Commercial taste requires sugar to have a large, sparkling, hard grain; and chemists are cognizant of the fact that the size of any crystal is mainly determined by two conditions—the first being evaporation at a low temperature, the second a slow process of cooling. Ordinarily, as regards sugars, the second indication can only be fulfilled; but the employment of the vacuum-pan also achieves the former.

Inasmuch as sugar has to be transported long distances by sea, this would afford a reason, were there none else, why it should be perfectly drained from its mother liquor. Here, then, is another indication, very easy to be carried out if the former one have been fulfilled,—*i.e.*, if the sugar have been made to aggregate into large and distinct crystals from the interstitial spaces between which the liquid can easily pass away.

Such are the chief indications to be followed out in the sugar manufacture,—indications which we shall hereafter find, when discussing the actual practice amongst different races, to be most culpably violated.

* From the Arabic *sukhur*, or *shukkur*.
† Ed. Heinsii, 1613, p. 475.
‡ De Causis Plant., lib. vi., c. 16., Ed. Heinsii.
§ Book iii., verse 237.

A COURSE OF PRACTICAL PHARMACY.*

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXI.

(LECTURE LIX.)

LIQUID STORAX.

We are as yet doubtful as to the source from which liquid storax is derived. Most authorities look upon it as the product of Liquidambar altingi and some other trees of the same family. Its odour is altogether similar to that of liquidambar.

According to Simonde, liquid storax is composed of

Volatile oil,
Resin,
Styracine,
Cinnamic acid.

The volatile oil of liquid storax is usually called styrol; it is a pure hydrocarburet; it is fluid; with nitric acid it yields some curious

* Continued from the *Pharmaceutical Times*.

products, among others a nitrogenized, volatile matter equalling in acridity the essential oil of mustard.

The resinous matter is a compound of two resins, a hard and a soft one; the latter may be analogous to cinnameïne.

Styracine was discovered by M. Bonastre. It has been most carefully examined and studied by M. Simon. It forms fine, white, elongated needles, which fuse at 122° Fahr., and are composed of

$$C^{24}\ H^{31}\ O^{3}.$$

It is insoluble in water, soluble in three parts of ether, three parts of boiling, and twenty-two parts of cold, alcohol. With nitric acid it comports itself like cinnamic acid, to which it bears considerable resemblance. Among other products it yields hydrocyanic acid and hydruret of benzoyle. Caustic alkalis convert it into resin, cinnamic acid, and a heavy oil (termed by Simon "styracone"), which boils at 428° Fahr., and exhales an agreeable smell of roses, almonds, and cinnamon. This oil contains nine per cent. of oxygen.

Styracine is extracted from the balsam by the following process:—Distil the balsam with carbonate of soda, to remove the essential oil; wash the residuary resin in water, and dissolve it subsequently in alcohol. Distil off two thirds of the solution; the impure styracine will subside from the residuary fluid on cooling. Wash the deposit with alcohol, and dissolve it subsequently in ether; evaporate the ether, and redissolve the residue in boiling alcohol; from this solution the styracine will crystallize on cooling.

According to M. Lhéritier, liquid storax is as efficacious in blennorrhœa and leucorrhœa as copaiba balsam, and may be advantageously substituted for the latter, as patients take it with less repugnance.

When liquid storax is intended for internal use it ought first to be purified; this is done most simply by melting it, and straining the melted mass through a linen cloth. M. Lepage has recently proposed a method of purification by means of alcohol. This process, however, besides being rather complicated, is unavoidably attended with the separation and loss of some of the principles of the storax.

PILLS OF STORAX.

Take of Purified liquid storax, q.l.
Liquorice powder, q.s.

Mix into boluses of from thirty to forty centigrammes each.

Dose: Six per day, three in the morning, and three at night. This dose may subsequently be increased to eight, ten, and twelve boluses per diem.

M. Lepage advises to prepare these pills with one eighth of calcined magnesia, to be kept in contact with the balsam for half an hour in the water-bath.

SYRUP OF STORAX.

Take of Purified liquid storax, 2 parts.
Alcohol of 40°, 51 parts.
Sugar, 60 parts.
Gum arabic in powder, 3 parts.

Dissolve the storax in the alcohol, pour the boiling and filtered solution over the sugar, and dry the moistened sugar in the stove. Pound the dried sugar and dissolve the powder in 300 parts of water in the water-bath; add to the solution the gum arabic dissolved in fifty parts of water, and strain.

This syrup, which looks like an emulsion, contains in every twenty grammes forty centigrammes of styrax.—(Lepage.)

M. Lhéritier prepares his storax syrup by digestion in water. I prefer M. Lepage's formula, since the syrup prepared according to the latter must necessarily contain more resin than can be extracted by simple digestion in water.

STORAX OINTMENT.

Take of Colophony, 4 parts.
Resin elemi,
Yellow wax,
Liquid storax, of each 2 parts.
Walnut-oil, 3 parts.

Melt the colophony, elemi, and wax in a pan over a gentle fire, and add the storax cautiously. When the whole mass is melted add the nut-oil; strain through a cloth, and stir the ointment until nearly cold.

A species of crust forms on the surface of this ointment, owing to ensuing inspissation of the nut-oil, which, it is well known, belongs to the class of the siccative oils. When the ointment is required for use, this crust is to be removed.

FATS AND FIXED OILS.

The substances which owe their medicinal properties to the presence of fatty matters are naturally divided into three classes, viz:—

1. Substances which owe their properties solely to the fatty matter which they contain, as olive-oil, for instance, linseed-oil, sweet almond-oil, &c.

2. Substances in which the fatty matter is associated with some active principle, as is the case, for instance, with castor-oil and cod liver-oil.

3. Substances in which the fatty matter is associated with essential oil. Nutmegs and laurel belong to this class, for instance.

We find in animals and plants fatty matters which, according to their original consistence, are termed suet, grease, butter, or oil.

In plants these fatty matters are contained more particularly in the seeds; sometimes, however, though more rarely, we find them in the fruits. The fatty matters supplied by plants and animals are either solid or liquid. They are so analogous in their composition that it is impossible to separate the study of those derived from plants from that of those derived from animals.

Fatty substances are readily fusible; in the fused state they are soft to the touch; they stain paper and render it translucid. A large proportion of carbon and hydrogen enters invariably into their composition.

Fatty substances were a long time looked upon as simple bodies. The labours of Braconnot, but more particularly those of Chevreul, have clearly demonstrated that, notwithstanding the great diversity of fatty substances, they are all of them formed by a small number of peculiar principles, mixed in divers proportions.

The elementary fatty principles may be divided into four groups, viz.:—

1. Principles which the alkalis fail to act upon.

These are:—

Cholesterine,
Ceraïne,
Ethal,
Myricine,
Ambreïne.

2. Principles which the alkalis convert into glycerine and imperfectly volatile fatty acids.

These are:—

Stearine,
Margarine,
Oleïne,
Ricinine.

3. Principles which the alkalis convert into oleïc acid and margaric acid, and into a fatty, non-saponifiable matter.

These are:—

Cetine,
Cerine.

4. Principles which the alkalis convert into glycerine, fatty volatile acids, and oleïc and margaric acids.

These are:—

Phocenine,
Butyrine,
Hircine.

We have to occupy ourselves here simply with the fatty principles of the second class (with the exception of ricinine), viz., stearine, margarine, and oleïne, which constitute, by their intermixture in divers proportions, nearly the whole of the known oils and fats.

The fatty substances of vegetable origin are most of them formed of oleïne and margarine; those of animal origin of stearine, oleïne, and margarine. Butter, however, contains no stearine; whilst, on the other hand, cocoa butter and the thick nutmeg-oil contain this principle.

STEARINE.

Stearine is white, solid, inodorous, and tasteless. It crystallizes in small, nacreous, and shining laminæ. It fuses at 143.6 Fahr. The mass which it forms on cooling looks like wax, and presents no appearance of crystallization; this mass is so friable that it may be reduced to powder.

Stearine is insoluble in water, but soluble to some extent in boiling alcohol; it separates, however, again almost completely from the alcoholic solution on cooling. Boiling ether dissolves it in large proportion, but on cooling retains of it only the 1-225th of its own weight. Upon saponification stearine changes entirely into glycerine and stearic acid.

Stearine is prepared best by fusing mutton suet in the water-bath, adding to the fused mass, gradually and cautiously, an equal weight of ether, allowing the mixture to cool, and, when cold, pressing it in a cloth and between folds of bibulous paper. The same operation is to be repeated with the expressed mass until its point of fusion remains fixed at 143.6 Fahr.

MARGARINE.

Margarine is a white, solid, colourless, and inodorous substance. It is much more readily fusible than stearine, its point of fusion being 116.6 Fahr. With water and alcohol it comports itself very much like stearine; cold ether, however, dissolves it in considerable proportion. When converted into soap it yields glycerine and stearic acid (fusible at 158° Fahr.).

We find in plants another species of margarine which fuses at 82.4 Fahr., and yields margaric acid (fusible at 138.2 Fahr.) when converted into soap.

This latter is the true margarine, the former being probably simply an isomeric variety of stearine.

OLEÏNE.

Oleïne is the liquid constituent of fats. It solidifies at about 24.8 Fahr. Pure oleïne (*i.e.*, as pure as we can get it) is almost colourless, or, at all events, but very slightly coloured. Its density is from 0.912 to 0.929. It is insoluble in water, but more readily soluble in alcohol than stearine and margarine; it is, however, equally more readily soluble in boiling than in cold alcohol. Ether dissolves it almost in all proportions. When converted into soap it yields glycerine and a mixture of margaric acid with a large proportion of oleïc acid.

All attempts to obtain oleïne in a state of perfect purity have hitherto failed.

Stearine, oleïne, and margarine compose most of the vegetable and animal fats. The greater or less fluidity or solidity of the products formed by these three principles depends upon the respective relative proportions in which they are combined. In most instances these principles are simply mechanically intermixed: in such cases the fluid part may be separated with tolerable exactness from the solid portion, by cooling or freezing the fat, and subjecting it subsequently to compression in bibulous paper. In other cases the constituent principles of the fat are chemically combined: in such cases, of course, mechanical separation would be attempted in vain. The stearine is simply mechanically mixed with oleïne in the animal fats; the same is the case with margarine in the animal fats, in palm-oil (Cocos butyracea), and nutmeg-oil. The solid portion of olive-oil is constituted by oleïne and margarine in actual chemical combination. Cocoa butter is constituted in the same way by oleïne and stearine.

The divers oils and fats differ in colour; the colour which they respectively present is owing to the presence of certain colouring matters, since stearine, margarine, and oleïne are all three colourless.

The respective odour of the different fats and oils is imparted to them by the presence of divers matters, such as volatile oils, for instance, or fatty acids (as in butter and suet).

The taste of fats and oils is equally owing to the presence of some extraneous principles.

The fats are less dense than water. Some of them are liquid at the common temperature, as sweet almond-oil and linseed-oil, for instance. Others are readily liquefied by heat. Every one of the fats may be decomposed by heat; one of the products of the decomposition of fats by heat is an acid matter similar to that which is produced in their saponification.

When exposed to the air fats and oils slowly absorb oxygen, and turn rancid. The phenomena ensuing upon exposure of oils to the air are particularly remarkable. The absorption of oxygen proceeds at first very slowly, but, after some time, it becomes very rapid. In some cases the heat generated by the process is so considerable as to determine actual ignition of the oil; this latter effect, however, is produced only when the oil is present in a large quantity, and presents a considerable extent of surface to the air. On thus absorbing oxygen from the air, the oils do not form water, and but very little carbonic acid. Some of the oils thicken upon continued exposure to the air, and become at last quite dry and solid. Such oils are called *siccative* or *drying* oils. To this class belong castor-oil, and the oils of linseed, walnuts, hempseed, and poppy-seed. Those oils which turn rancid upon continued exposure to the air, but without drying, are called *non-siccative* oils, to distinguish them from the former. To this latter class belong olive-oil, rapeseed-oil, hazelnut-oil, sweet almond-oil, beechnut-oil.

The different deportment of these two classes upon exposure to the air is owing to certain differences presented by the oleïne respectively contained in the two classes. The oleïne of the siccative oils possesses the property of drying on exposure to the air, is less soluble in alcohol than the oleïne of the non siccative oils, and is not converted into elaïdine and elaïdic acid by the action of hyponitric acid.

The changes which fats and oils suffer on turning rancid have not been sufficiently studied; among other products fatty acids and glycerine are invariably formed, and the latter product frequently suffers further decomposition, more particularly in the presence of an animal matter, which seems to act as a ferment upon it.

The fats and oils are insoluble in water. They are, generally speaking, very sparingly soluble in alcohol, castor-oil and croton-oil being about the only two oils which this menstruum dissolves in a large proportion.

Oils and fats are freely soluble in ether.

The fatty substances are generally miscible in all proportions with the essential oils. They dissolve resinous matters and camphor, but fail to dissolve gum, sugar, and extractive matters.

Phosphorus and sulphur are soluble to some extent in oils and fats.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

REMARKS ON THE FIRST REPORT ON THE COALS SUITED TO THE STEAM NAVY BY SIR H. DE LA BECHE AND DR. LYON PLAYFAIR.

By Mr. LEWIS THOMPSON.

An accurate, systematic, and intelligible report upon the calorific properties of coal has long been needed by the manufacturing and mercantile interests of this country. In addition to the vast importance of such an inquiry, it would be perhaps impossible to point out a subject on which less difference of opinion exists as to the extent and nature of the information wanted than the one before us. Science, properly speaking, has little or nothing to do with the question; the object in view is purely and exclusively practical, and is meant for the guidance of practical men and for practical purposes. Theory, above all things, should be carefully avoided in such investigations; and, supremely indifferent about the assistance of any eminent chemist on such an occasion, we should, nevertheless, insist strongly upon the necessity of providing a good stoker. Mr. Hume, however, thought otherwise; and to him the country is indebted for the first report upon the coals suited to the steam navy. Of this report we will venture to say at once that a more garbled, more inaccurate, and less impartial job was never exhibited—nay, not even in the House of Commons. To begin at the beginning of this disgraceful affair, we will merely remark that Mr. Hume (whose honesty and integrity are beyond suspicion) directed the attention of the Lords of the Admiralty to a subject which, if these lords attended to anything but their salaries, must have occupied their attention years ago. Mr. Hume, after referring their lordships to an American report, with experiments, on the evaporative value of coal, says:—

"They have decided by direct and practical tests the comparative usefulness of American and English coals, as well as the relative value of the former in their numerous varieties; and I submit to your lordships that a similar inquiry should be instituted into the comparative usefulness of English, Scotch, and Irish coals, with the view of ascertaining the best for the naval steamers of this country. I may be allowed to point out to your lordships that there is a public establishment in Craig's-court perfectly qualified to apply the requisite direct and positive tests to the coals without delay; and to that establishment may be added one chemist of eminence to assist in what is an object of great national importance."

Upon this the Admiralty applied to Sir H. de la Beche, who, after the usual preliminary remarks, observes:—

"As the funds of the Museum of Economic Geology are, unaided, inadequate to an investigation of this order, I would suggest that the Admiralty be requested to furnish aid to the amount of £600 for the remainder of the year ending the 31st of March, 1846. With this aid I have little doubt that we should be enabled to accomplish much this year which may be of value, and have organized a system of inquiry alike effective, and, viewing its national importance, which can be carried out at comparatively small cost to the public."

We must content ourselves by guessing at the meaning of the last paragraph, and, as far as this can be done with safety, we may conclude that, in the opinion of Sir H. de la Beche, the funds of the Economic, plus £600, would answer the object in view, to wit, the obtaining a practical report upon the evaporative power of English, Scotch, and Irish coals. If anything else is meant, why is £600 named? The question is very fairly put by Lord Lincoln, who, in reference to the establishment in Craig's-court, asks, in plain English, "What is the course you would recommend for making it effective for the purposes to which such an inquiry would be obviously directed?" Sir H. de la Beche in answer mentions £600 in addition to the funds of the Museum of Economic Geology; yet something more appears to have been given by the following "memorandum":—

"The Admiralty having acceded to the recommendation made in the foregoing letter, and subsequently also supplied additional funds for the investigation, the latter was commenced as soon as the needful apparatus was erected and proper assistance procured, which could not be accomplished until March, 1846."

Now, what is the meaning of the additional funds supplied for the investigation? Were the funds of the Economic, plus £600, spent on apparatus alone? And was it to the mere erection of this apparatus that Sir H. de la Beche alluded when, in 1845, he wrote, "With this aid I have little doubt that we should be enabled to accomplish *much* this year," &c.?

There is a mystery about the very commencement of that business; seldom do we find Government officials ready to comply with the prayer of a petition which has merely public utility to recommend it; but Mr. Hume has nothing to complain of on that score in the present instance, for in addition to the Craig's-court establishment he solicited but one chemist, when lo! the investigation falls into the hands of Dr. Lyon Playfair, Mr. Wilson, Mr. J. Arthur Phillips, Mr. Kingsbury, Mr. Wrightson, Mr. Galloway, Mr. How, and William Hutchinson, all and each endowed with qualifications of a peculiar and important character, bearing upon the investigation in hand, and tending, of course, to render the report superlatively correct, useful, impartial, &c. &c. There is an old axiom regarding broth made by a multiplicity of cooks, but perhaps it does not apply to parliamentary reports and chemists.

The mystery does not, however, end here. Mr. Hume had requested that the inquiry should be made upon English, Scotch, and Irish coals. Now, the following is the list of coals operated on:—

NAMES OF COALS EMPLOYED IN THE EXPERIMENTS.

WELSH—
- Graigola,
- Anthracite, Jones and Co.,
- Old Castle Fiery Vein,
- Ward's Fiery Vein,
- Binea,
- Llangenneck,
- Pontrepoth,
- Pontrefellin,
- Duffryn,
- Mynydd Newydd,
- Three Quarter Rock Vein,
- Cwm Frood Rock Vein,
- Cwm Nanty Gros,
- Resolven,
- Pontypool,
- Bedwas,
- Ebbw Vale,
- Porth Mawr,
- Coleshill.

SCOTCH—
- Dalkeith Jewel Seam,
- Dalkeith Coronation Seam,
- Wallsend Elgin,
- Fordel Splint,
- Grangemouth.

ENGLISH—
- Broomhill,
- Lydney (Forest of Dean).

IRISH—
- Slievardagh Irish Anthracite.

From which it appears that the inquiry has been made almost exclusively upon Welsh coals, for, out of twenty-seven samples of coal examined,

19 were Welsh,
5 " Scotch,
2 " English,
1 was Irish.

One of two things is very plainly exhibited by this table: either Wales is, above all other places in the world, blessed with coals "suited to the steam navy," or a most unjust, uncalled-for, and villanous selection has been made for private purposes. It is vain to talk of a next report; it will require years to complete another report, even if such another disgraceful exhibition of partiality was attempted; and meanwhile our steam navy must be supplied with the euphonious productions of Wales, to the exclusion of the vast coalfields of Newcastle. Of the two samples of English coal examined I am practically acquainted with but one, for of the Lydney coal I know nothing; as regards the Broomhill coal, however, I can safely assert that its only recommendation consists in its belonging to Earl Grey, for at Newcastle it is regarded as an unimportant second-rate coal, the very name of which has not yet found its way into the London market. It is far inferior for steam purposes to the whole of the undermentioned coals, many of which are, in fact, the best steam coals for sea-going vessels in the kingdom:—

- Carr's Hartley,
- Hasting's Hartley,
- Hedley's Hartley,
- Newcastle Hartley,

Percy North Hartley,
Richardson's Hartley,
West Hartley,
Bate's West Hartley,
Buddle's West Hartley,
Davidson's West Hartley,
Nelson's West Hartley.

Why these and many others have been passed over so unceremoniously to make room for the wholesale introduction of the Welsh coal remains to be explained; we will now, however, examine the report itself.

The first circumstance which attracts attention in this report is the appearance of certain very simple simple equations, which, although well enough adapted for a boy just commencing algebra, are singularly out of place here, since those who understand such things generally prefer to make their own; and those who do not are but little likely to benefit by such a display of learning.

A curious attempt is made at page 13 to prove that the evaporative value of a bituminous coal is expressed by the evaporative value of its coke:—

"It is easy," says the report, "from analysis to examine whether the duty performed by the coal is to be attributed to its fixed ingredients or coke, by estimating the work which the latter is capable of performing. This may be done by subtracting the ashes in the coal from its amount of coke, and estimating the remainder as carbon; this carbon multiplied by its heating power, 13268, and divided by 965.7, or the latent heat of steam, indicates the number of pounds of water which the coke by itself could evaporate without the aid of the combustible ingredients of the coal. These results are placed, in column B of Table 6, in juxtaposition with the actual work done by the coal, and it will be seen that, notwithstanding several striking exceptions, which might have been expected, they on the whole show that the work capable of being performed by the coke alone is actually greater than that obtained by experiments with the original coal."

EXTRACT FROM TABLE 6, SHOWING THE ACTUAL DUTY AND THAT WHICH IS THEORETICALLY POSSIBLE OF THE COALS EXAMINED.

Name or Locality of Coal.	Actual Number of lbs. of Water Converted into Steam by 1 lb. of Coal. Practical.	Number of lbs. of Water Converted into Steam by the Coke left by the Coal. Theoretical.	Total Number of lbs. of Water Convertible into Steam by 1 lb. of the Coal. Theoretical.	Amount of Ammonia Corresponding to the Nitrogen Contained in the Coal.	Amount of Sulphate of Ammonia Corresponding to the Nitrogen Contained in the Coal.
Graigola	9.35	11.301	13.563	0.497	1.932
Anthracite, Jones and Co.	9.46	12.554	14.593	0.225	0.990
Old Castle Fiery Vein	8.94	10.601	14.936	1.590	6.175
Ward's Fiery Vein	9.40	..	14.614	1.238	4.808
Binea	9.94	11.560	15.093	1.586	6.741
Llangenneck	8.86	10.599	14.260	1.299	5.044
Pontrepoth	8.72	10.873	14.838	0.218	0.848
Pontrefellin	6.36	10.841	13.787	a trace	—
Powell's Duffryn	10.149	11.134	15.092	1.76	6.835
Mynydd Newydd	9.52	9.831	14.904	1.808	7.340
Three Quarter Rock Vein	8.84	7.081	13.106	1.299	5.044
Cwm Frood Rock Vein	8.70	8.628	14.788	1.347	5.232
Cwm Nanty Gros	8.42	8.243	13.932	1.919	7.448
Resolven	9.53	10.234	13.971	1.675	6.505
Pontypool	7.47	8.144	14.295	1.639	6.364
Bedwas	9.79	8.897	14.841	1.748	6.788
Ebbw Vale	10.21	10.441	15.635	2.622	10.182
Porth Mawr Rock Vein	7.53	6.647	12.811	1.554	6.033
Coleshill	8.0	6.468	12.799	1.785	6.930
Dalkeith Jewel Seam	7.08	6.239	12.313	1.214	0.471
Dalkeith Coronation	7.71	6.924	12.772	a trace	—
Wallsend Elgin	8.46	6.560	13.422	1.712	6.647
Fordel Splint	7.56	6.560	13.817	1.372	5.327
Grangemouth	7.40	7.292	13.692	1.639	6.364
Broomhill	7.30	7.711	14.863	2.234	8.674
Park End Lydney	8.52	6.567	13.257	1.477	9.617
Slievardagh	9.85	10.895	12.482	0.279	1.084

Now, if this table proves anything, it proves the very reverse of the position attempted to be established, unless theory is presumed to be equal to practice, which it certainly is not, or why the necessity of spending upwards of £600 in practical experiments? But theory may justly be compared with theory, and then the table, so far from proving "that the evaporative value of a bituminous coal is expressed by the comparative value of its coke," clearly proves that the evaporative power of a bituminous coal is an immense deal greater than that of its coke; indeed almost double; and that the volatile ingredients of coal evolve in burning relatively a much greater proportion of heat than the fixed constituents; this is, indeed, precisely what might have been expected from the well-known calorific power of hydrogen, which is three times greater than that of carbon. There is, however, clearly a design throughout this report to extol the anthracitic coals at the expense of the bituminous; and, if Messrs. De la Beche and Co. could succeed in establishing the fact that the heating power of coal is due solely or even principally to its relative amount of carbon, it follows that Welsh coal must rise in the market, for the greater part of the coal from that district is of the anthracite kind, none of which is worked in the north of England. To prove the absurdity, however, of the above attempt, I will quote two or three cases from Table No. 6:—

Name of the Coal.	Theoretical Weight of Water Evaporated by Coke.	by Coal.	Excess due to Volatile Ingredients.	
WELSH—				
Graigola	11.301	13.563	2.262	The thing speaks for itself.
Old Castle Fiery Vein	10.601	14.936	4.335	
Mynydd Newydd	9.831	14.904	5.073	
SCOTCH—				
Dalkeith Jewel Seam	6.239	12.313	6.074	
ENGLISH—				
Broomhill	7.711	14.863	7.152	

After theoretically demonstrating that "the evaporative value of a bituminous coal is expressed by the evaporative value of its coke, the heat of combustion of its volatile products proving in practice little more than that necessary to volatilize them," we are suddenly greeted with the following paragraph:—

"The whole system of manufacturing coke is at present very imperfect. Besides losing the volatile combustible substances, which, under new adjustments, might be made of much value, an immense quantity of ammonia is lost by being thrown into the atmosphere. Ammonia and its salts are daily becoming more valuable to agriculture, and it is their comparative high price alone which prevents their universal use to all kinds of cereal cultivation. By a construction of the most simple kind the coke-ovens now in use might be made to economize much of the nitrogen, which invariably escapes in the form of ammonia. As an inducement to this economy, we have appended to Table 6 two columns showing the quantity of ammonia and its corresponding quantity of commercial sulphate which each 100 lbs. of the respective coals may be made to produce. When it is remembered that the price of sulphate of ammonia is about £13 per ton, or that 100 tons (of coal, we suppose) in coking is (are?) capable of producing on an average about six tons of this salt, its neglect is highly reprehensible."

Nothing has tended half so much to retard the cultivation of chemistry by our practical manufacturers as the kind of statements of which the above is a sample. Written by individuals wholly ignorant of the subject of which they treat, these assertions serve only to amuse practical men, and to demonstrate the stupendous folly and assurance of their authors. Imperfection is an attribute of humanity, but that the present system of making coke is very imperfect remains to be proved.

The volatile combustible matter of the coal is not lost; on the contrary, it is employed as a means of converting the cinder of the coal into coke, and that, too, by the heat which it evolves in burning; and, if that heat was so inconsiderable as the report would lead us to suppose, mere cinder alone would remain in the coke-oven, even after the heat had been kept up for ninety-six hours. Perhaps the framers of the report may want to know the distinction between cinders and coke. Coke, if good, sinks in water; bad coke or cinder swims. The reason of this is very simple. The longer and higher the heat to which carbon from wood or coal is exposed the more it contracts, and consequently the denser it becomes. The volatile combustible matter of the coal is employed then in producing the requisite temperature for coking, and the oven is so contrived as to retain the heat a sufficient time to produce the necessary aggregation of the particles of carbon, or, in plain words, the condensation of the coke: to assert that this volatile combustible matter is lost is perfectly ridiculous. We are next informed that "an immense quantity of ammonia is lost by being thrown into the atmosphere," and that by "a construction of the most simple kind this loss might be avoided." Lord Dundonald, about forty years ago, had the same idea, and tried it on a large scale; it is unnecessary to say that it proved to be a complete failure, although sulphate of ammonia was then worth four or five times its present price. But the most absurd part of this scientific soap-bubble is contained in the last sentence:—"100 tons in coking is capable of producing on an average about six tons of this salt" (sulphate of ammonia). Now, let us for a few minutes imagine my Lord Grey desirous (as we have no doubt he is) of making the most of his Broomhill coal. Passing his eye down column 1 of Table 6, he sees at a glance that 100 tons of coal will produce 8.674 tons of sulphate of ammonia, worth £13 per ton. Making a little allowance for loss, he says to himself, "Well, call it 8½ tons; and now how much sulphuric acid is required?" We will suppose him practically acquainted with Dr. Wollaston's scale, and that, valuing common "chamber acid" at three farthings per cent., he has arrived at the following conclusion:—

	£	s.	d.
100 tons of coal, at 3s. 4d. per ton =	16	13	4
6½ tons of sulphuric acid, as above =	45	10	0
	62	3	4

will produce

	£	s.	d.
8½ tons of sulphate of ammonia, worth	110	10	0
and 70 tons of coke, at 8s. 6d. per ton	29	15	0
	140	5	0

A promising speculation truly, if his lordship could only economize "the nitrogen which *invariably* escapes in the form of ammonia." But, most unfortunately, the nitrogen does not "invariably escape in the form of ammonia," for in practice 9-10ths of it invariably escape in the form of nitrogen, as any experienced gas-manufacturer can testify, and as the experiments quoted in the report abundantly prove, for according to Mr. F. C. Wrightson (a pupil of Liebig), who (vide Report, page 6) had fitted "himself by special study for an undertaking requiring so much delicacy of manipulation,"—according, then, to Mr. Wrightson (page 58), the Binea coal and the Llangenneck coal gave by actual experiment in 100 parts 0.08 of ammonia, or .310 of sulphate of ammonia. Now, if we compare this with Table 6 we shall find :—

Binea coal	might, could, would, or should produce	6.741	really did produce	0.310
Llangenneck		5.044		0.310

or about 1-20th of the quantity theoretically obtained by Sir H. De la Beche and Dr. Lyon Playfair ; yet these are the individuals who find fault with our manufacturers, and pretend to improve our processes. With quite as much practical utility might these gentlemen have detailed to us the quantity of pure diamond which the coals in question would produce, if we knew how ; as the amount of ammonia which they might give off, if they would. Of the analytical part of the report we will say little more than that it is in perfect keeping with the rest. In the first place, chloride of calcium is employed to remove water and ammonia from the gas, although a very little practical knowledge of gas purification would have taught the operator that, when water and ammonia are absorbed by chloride of calcium, carbonic acid is also taken up, so as to produce carbonate of lime and muriate of ammonia ; and as this carbonic acid must have been regarded either as ammonia or water, it follows that the experimental results are valueless. The substance which ought to have been employed to absorb water and ammonia under the circumstances is the fused or glacial phosphoric acid ; but what real value can we attach to experiments made upon less than half a grain of coal, in which the errors, and errors there are, have been multiplied at least 300,000 times? For example, at page 58, we find "Anthracite, from T. Aubrey and Co." The quantity of this coal taken for analysis was 0.2763 of a grain, or rather more than ¼ of a grain. Now, supposing it had even equalled ⅓ of a grain, then to bring this to a pound it must be multiplied 21,000 times, and to raise this last to the weight of water which 1 lb. of such coal could theoretically evaporate, as represented at column E of Table 6, this 21,000 must be multiplied by 14.593; therefore, if any error occurred in the analysis of this Anthracite coal, it has been multiplied upwards of 306,453 times, in regard to the quantity of water which 1 lb. of such coal can evaporate, as exhibited in column E of Table 6. The idea, however, of weighing the 1-10000th of a grain is perfectly new to us, who have always regarded even the 1-1000th as something too nearly approaching the imponderable. These remarks apply equally to the experiments with litharge ; no allowance is made or notice taken of the error arising from the presence of iron pyrites in the coal, although this substance would reduce more than nine times its weight of litharge, and the error thus produced has been multiplied upwards of 90,000 times in column F of Table 4; and in the case of the Anthracite coal above mentioned this error has been increased 104,507 times. Nor is the quantity of iron pyrites inconsiderable in many of these coals, for, according to Table 3, the following contain a portion of sulphur equivalent to bisulphuret of iron, as under :—

Slievardagh	12.67 p. ct.	Of iron pyrites for which no allowance has been made in the litharge expts.
Resolven	9.50 "	
Bedwas	6.56 "	
Cwm Nanty Gros	5.64 "	

To pretend to attach any value to such experiments, or to the conclusions drawn from them, is a mere fallacy, and, as the whole of the theoretical part is based upon these analyses, with them it must fall to the ground as erroneous and illusory. Under these circumstances it becomes necessary to inquire most carefully into the large and practical essays made for the purpose of determining the quantity of water evaporated during many successive hours by considerable quantities of each particular coal. With a few exceptions, each coal was burnt for eight hours, and the experiment repeated three times, the quantity of coal consumed and of water evaporated being noted in each instance, and an average drawn from the three results obtained by each coal. If carefully conducted, this method ought to have furnished some valuable information, but the discrepancies in respect to the three results obtained from some of the coals are so enormous and unaccountable as to render the whole table suspicious, doubtful, and therefore valueless ; indeed, the differences observable between many of the different samples of coal are much less than the experimental differences given by one and the same coal, and which occasionally amount to little short of twenty per cent., as the following table will show :—

Name of Coal.	Extreme Difference in Three Trials as to the Amount of Water evaporated by each respective Coal.
Duffryn	2.3 per cent.
Old Castle	11. "
Ward's	5.3 "
Binea	14.7 "
Llangenneck	16. "
Mynydd Newydd	4.9 "
Three Quarter	1.4 "
Graigola	2.1 "
Lydney	11.8 "
Pontrepoth	9.1 "
Cwm Frood	1.3 "
Anthracite	5.6 "
Cwm Nanty Gros . ..	4.8 "
Grangemouth	6.7 "
Broomhill	5.2 "
Resolven	18.9 "
Pontypool	17.7 "
Bedwas	13.4 "
Porth Mawr	9.5 "
Ebbw Vale	15.7 "
Fordel Splint	14.5 "
Coleshill	11.5 "
Wallsend Elgin	7.3 "

The idea of forming a table from experiments producing such discordant results is altogether preposterous, yet, turn in what direction we may, the same evidence of blundering and incapacity presents itself. In the first place, the selection of the coals was bad and unfair in the extreme, and no way calculated to answer the practical end in view; secondly, the proximate analyses are worthless, from the employment of chloride of calcium to a purpose for which it is not adapted ; thirdly, the ultimate analyses are made in quantities too small to entitle them to any confidence when their results are raised to practical purposes ; fourthly, the litharge experiments are erroneous ; and fifthly, the practical essays by means of the Admiralty boiler are so completely at variance amongst themselves as to defy all arrangement or computation.

The entire report is, in fact, a disgrace to the age and country we live in, and carries with it all the internal evidence of a job.

As it is possible, however, that the Admiralty may really be serious in its desire to ascertain the real value of steam-coal, we will venture to throw out a few hints, in order that that august body of well-paid functionaries may look before they leap into a subject so intimately connected with our national interests.

In working a seam of coal, experience has shown that the quality of the coal is not uniform, and that a coal may be improving or deteriorating as the workings are carried on, in one or another direction. From this it follows that any particular coal examined, say in 1846, is by no means to be regarded as possessing the same value in 1848, since this may have changed considerably, if the working of the coal has been carried on to any great extent; and it is the determination of this very fact which constitutes the real source of utility to be derived from a Government investigation. The proximate value of a coal is soon determined by actual experiment, from the amount of work done, and a market value is given in accordance with these rough results ; but, when once that value has become fixed, there it remains for many years, whether the coal continues uniform or not, and it is only slowly and by degrees that the change becomes apparent. An establishment for determining matters of this kind is, therefore, much needed, but, to be useful, it must obviously be permanent. Again, as the transmission of heat from one body to another is proportional to the difference of temperature between the bodies themselves, it is clear that the water operated on should have one uniform temperature in all the experiments, and there are many reasons why this should be the boiling-point. The quantity of water evaporated should not be inferred from the quantity which has escaped from a boiler during an experiment; independent of the possibility of leakage, much water is occasionally carried off mechanically by the steam, hence the origin of "priming." The most unobjectionable method would be to distil the water and afterwards measure it, the still-head being provided with a return-pipe, as is usual, for the fluid mechanically projected. The ordinary modes of favouring the transmission of heat from the furnace to the boiler, and of preventing its escape in any other direction than into the refrigeratory, should be had recourse to. A chemist is of no use for such investigations; if any chemical question should arise out of the experiments, it would be better to consult some one of established reputation. The stoker should be intelligent, and practically acquainted with the different modes of firing necessary for anthracitic, open-burning, and bituminous or caking coal ; for whilst the first of these will take, nay requires, eighteen or twenty inches of fuel on the bars, the last will not bear more than four or six, without an enormous loss of heating-power. To this cause must be ascribed much of the discrepancy apparent in the experimental results obtained by the Admiralty boiler.

PHARMACEUTICAL SOCIETY.

Nov. 7.—Mr. Morson in the chair.

A paper by Mr. Allchin was read on the supposed antidotal action of meconic acid in cases of poisoning by corrosive sublimate.

Dr. Christison, in his "Treatise on Poisons,' 4th edition, states that meconic acid is probably a good antidote to the action of corrosive sublimate. This statement appears partly to arise from observation of the counteracting effects of opium in such cases, and partly from the supposed tendency of meconic acid to form insoluble salts with metallic oxides. Being unable to find direct evidence upon this important question, the author undertook several experiments, as follows. The results he considers imperfect, but their distinct tendency is to show that reliance on meconic acid as an antidote in these cases of poisoning is misplaced :—

1. Six grains of corrosive sublimate dissolved in half an ounce of water were given to a full-sized guinea pig. The animal immediately exhibited signs of great uneasiness, and vomited a greenish matter. Eight minutes afterwards fifteen grains of

meconic acid dissolved in water were given, and produced no effect. The dose was repeated five minutes after; but the animal died in twenty minutes from the administration of the poison.

2. To a smaller guinea pig four grains of corrosive sublimate were given, dissolved as in the foregoing case, and in ten minutes twenty grains of meconic acid were given. The animal sank rapidly, the meconic acid producing no effect.

3. Ten grains of meconate of mercury were given to a full-grown rabbit. The animal was seized with violent convulsions in its limbs, and was greatly purged. It refused food, was insensible, and died in fifty-six hours.

These experiments, which are not so satisfactory as might be wished, leave little doubt that the poison continues to exert a powerful influence, notwithstanding the early administration of the supposed antidote, and that, even should the corrosive sublimate be converted into meconate of mercury before death, the latter salt is a potent poison.

Insoluble meconates are very slowly precipitated, as the three preceding experiments show.

The question remains, to what are the counteracting effects of opium in poisoning by corrosive sublimate due? The author dissolved thirty grains of opium in proof spirit, and added three grains of bichloride of mercury. Copious precipitation took place, but at the expiration of six hours the presence of the metal was readily discoverable by the proper tests. He concludes that neither meconic acid nor the soluble meconates can be relied on, and that the efficacy of opium is due partly to the colouring matter, gum, &c., and partly to its general tendency to modify the symptoms and alleviate suffering.

Mr. Deane read a paper supplementary to Dr. Pereira's paper on the magnesias of commerce. The author gives the details of many experiments of little general interest, a selection from which will probably appear in a future number. He observes that the processes given by different writers for the preparation of dense carbonate of magnesia are not followed by the same results. Dr. Christison, on the authority of Bucholz, gives a process for its preparation in which considerable excess of alkali is present. He directs to mix boiling solutions of four parts of sulphate of magnesia in twenty-four of water, and four parts and three quarters of carbonate of soda in fourteen of water, and boil for some minutes. But the carbonate resulting from this process consists of larger granules than those of the ordinary dense magnesia, and on this account Mr. Deane prefers the formula of the Pharmacopœia Londinensis.

Mr. Fordred wished to be informed how the heavy calcined magnesia, of which no mention had been made either in Dr. Pereira or Mr. Deane's paper, was prepared. Mr. Phillips had some time ago shown that the heavy carbonate became light by calcination.

Mr. Redwood, Mr. Morson, and Mr. Deane considered it as generally understood that the heavy calcined was always prepared from the heavy carbonate, and did not appear prepared to hear of any difficulty in the process of conversion. A practical gentleman present said that he was in the habit of preparing great quantities, and that by continued exposure to heat the heavy carbonate might become calcined without that loss of density to which Mr. Fordred had alluded.

Mr. Jacob Bell read a paper on the preparation of the essential oil of lavender, the object of which was to show that distillation from flowers only is not necessarily a more expensive process than that of distillation from flowers and stalks imperfectly separated. In distilling essential oil of lavender upon a large scale a considerable proportion of stalk is thrown into the still with the flowers. The quality of the oil as it is found in the shops varies much, on account of admixture with foreign oil; but even the genuine oil differs greatly in quality, according to the circumstances under which it is prepared. The object of the author's experiments was to ascertain to what extent the proportion of stalk permitted to undergo distillation with the flowers influences the result. The flowrets were carefully stripped off from the stalk, and alone found their way into the still. Distillation was conducted in the usual way by steam. Thirty gallons of water were used for every cwt. of flowers.

In the first seven experiments 99 lbs. of flowers yielded 1 lb. 7 oz. of oil, at a cost of 64s. per lb. In the remainder the resulting (the quantity of flowers used and of oil yielded was not given) cost was for thirteen experiments respectively as follows:—64, 53, 61, 70, 53, 53, 58, 63, 61, 57, 32, and 31 shillings per lb. The striking want of uniformity observable in the above sums is accounted for by the variations in the scale on which the operations were conducted, and the consequently unequal economy which was practicable. The price of flowers separated from the stalks was from 9d. to 11d. per lb. In the two last experiments the lavender was obtained in bundles, and two boys were two days picking it, so that the cost of their labour must be added to the result; but even with that addition the author contends that a saving is effected. The dealers will not supply the lavender picked without making an extravagant addition to the price, as it is a deviation from their routine; but it is thought that a little pressure on the part of consumers alive to the economy of operating only on the flowers will induce an alteration in that system, and that the price of flowers free from stalks will be in proportion to the present cost. The smell of the oil is not near so rank as that obtained partly from stalks. The experience of the author, who has tried this method for three years, decidedly inclines him to continue it, on account of the improvement in the quality of the product and of its economy, regard being had to the former condition.

Mr. Waugh observed that, according to Mr. Bell's account, the flowers must have gone into the still two days later than they need otherwise have done. He thought it questionable whether that was not a sufficient disadvantage to countervail the benefits insisted on by that gentleman. His advice was, get the lavender into the still as quickly as possible.

Mr. Bell knew a gentleman who systematically distils with the dry flowers, and who states that the oil he gains from them is less in quantity, but of a better quality, than that from the fresh flowrets.

Mr. Morson introduced the subject of the impurities of chloroform, standing over from the last meeting. He had availed himself recently of an opportunity to call attention of the members of the profession to the changes which chloroform undergoes, under certain circumstances of exposure, which unfits it for exhibition as an anæsthetic. The body in some cases becomes acid, and gives off hydrochloric acid; and, in fact, becomes entirely changed in its most important properties. He had suggested, as a means of detecting this change, to try it with litmus paper, and that when it was found acid it should not be used. In that paper he had used the word *pure* chloroform, and that expression had induced some friends at Edinburgh to remark on the expression, and to consider that he had not operated on pure chloroform, because they had not found the article as made in Edinburgh liable to decomposition like that made in London. These were the observations of Dr. Christison and Dr. Simpson. He (Mr. M.) had also seen a letter from Dr. Christison to a friend, in which it was stated that Mr. Morson's statement about the spontaneous development of muriatic acid in pure chloroform in certain cases, together with the remark of Dr. Periera, that he had a suspicion that such changes took place, had led the writer to investigate the question. There must have been some mistake, or the article must have been a different one. A few days after, seeing Dr. Pereira's letter, Dr. Christison examined some chloroform procured from a highly-respectable source, and found a portion, amounting to not more than half an ounce, at the bottom of a ten-ounce bottle, which had been exposed, so free from acid as not to have any effect whatever upon litmus paper. Since then he had examined another portion from a different source, and found it also free from acid, although it had been much exposed. The density of both specimens was 14.96, and both had been prepared with the greatest care. As the writer had never seen good chloroform made by others which did not correspond with this, he concludes that the article thus manufactured is pure. He states that he found in a London specimen so much acid as irritated his nostrils very considerably, and made him cough. He found that the same was true of many other specimens, which were thereby rendered quite unfit for use. Dr. Simpson has recently published in the monthly journal this fact, and in a note attached to it gives the process of one of the most respectable houses in Edinburgh.

Four pounds of chloride of lime and twelve pounds of water are first well mixed together, and then twelve ounces of spirit are added. Heat is then applied to the still (which ought not to be more than a third full); but as soon as the upper part of the still becomes warm the heat is withdrawn, and the action is allowed to go on of itself. In a short time the distillation commences, and whenever it is observed to go on slowly the heat is again applied. The fluid which passes over separates into two layers, the lower of which is chloroform. This, after having been separated from the weak spirit forming the upper layer, is mixed with half its volume of strong sulphuric acid, added gradually. The mixture, when cool, is poured into a leaden retort, and distilled from as much carbonate of baryta by weight as there is of sulphuric acid by measure. The product should be allowed to stand over quicklime for a day or two, and repeatedly shaken, and then redistilled from the lime. The sp. gr. is generally 14 96 or 14.97. This is the process of Messrs. Dunean and Flockhart. "Now," said Mr. Morson, "I have examined many specimens of chloroform made in England and in Scotland. I sent to the best makers in Edinburgh and in this country, and I am by no means sure that I have actually had in my possession a chemically pure specimen. They all differ both in purity and in the facility with which they undergo decomposition. Some of them undergo change in the course of a few days when exposed to air by the repeated opening of the bottle containing the liquid, and when exposed to the light of the sun directly falling on it. In respect to this latter influence, my experiments have not been much favoured the last few days. Some of the Scotch specimens have decomposed, and some of the London ones, although not wholly free from change, are fit for medical use. Some of this Scotch chloroform I have found will keep on the shelf of a common room for months; but when exposed to the sun in a shop-window it will decompose.

"The process just given, as followed in Edinburgh, is that of Dumas, as far as regards the formation of rough chloroform. There is another followed by Soubeiran, who, in 1831, first discovered chloroform.

"None of the authors who have written on the subject state what the sulphuric acid *does* for the chloroform, or what it removes from it. Yet it is evident that the nature of the substance should be ascertained, so that we may know the cause of decomposition taking place. Take rough chloroform, mix with oil of vitriol, the latter becomes of a blackish-brown colour. But, although you prepare several specimens of chloroform from the same materials in the same proportions, yet one sample does not blacken in the same degree as another. This must strike you with the conviction that there is a something in the rough chloroform which has not yet been considered, and in which probably is to be sought the solution of much that now embarrasses us.

"In the purification of chloroform I do not follow the Scotch process of distilling the oil of vitriol from carbonate of baryta. I always take the oil and wash it previous to rectification. There is a something, it is clear, removed by the

oil of vitriol from chloroform which does not belong to it, but what that is is by no means clear; and what is the body which undergoes this decomposition is not ascertained. The matter which blackens the sulphuric acid can be got rid of by simple rectification. If you examine what remains, after this process, at the bottom of the retort, you will find that it has a most intense blackening influence.

"I have had chloroform which has not undergone this process which is quite suitable for medicinal purposes, and, on the other hand, I have some which has been submitted to it which has undergone change. Alcohol, chloruretted lime, and water give rise to a number of bodies; and authors will tell you that if the lime be perfectly saturated with chlorine you do not get chloroform at all. The probabilities are, that you get one of this numerous class of bodies whose character has never yet been explained, but to which the name of heavy muriatic ether has been given. Dumas alludes to these under the title of *chloral*, an oily product resulting from the action of chlorine on alcohol. In this institution, whilst endeavouring to make chloral, they made something else, the alcohol not being free from water, or the chlorine not being sufficiently dry. I am inclined to think that when we mix together chloride of lime, alcohol, and water, where a sufficient excess of lime is not present, and the manipulation is not nicely timed, a quantity of this body is formed at the same time with chloroform, and passes over with it, and is not separated from it by the ordinary process of rectification, and, though the acid is neutralized, still, after a time, this substance undergoes decomposition. I think it is to this article that we must look as the source of the difficulty under which we labour. I am not prepared to tell you that all this is founded on such exact experiments as will warrant you in accepting it on my word. Many causes have prevented my giving my attention to it as I should have wished, and I hope some of our members will take it up. One point calls for notice. Drs. Simpson and Christison give the sp. gr. of chloroform 14.95. According to English and other authorities the numbers are 14.80,—a wide difference indeed."

ABSTRACTS FROM FOREIGN JOURNALS.

AN INQUIRY INTO SUBSTANCES EJECTED BY HECLA DURING ERUPTION.

[From the *Annalen der Chemie und Physik.*]

It is a matter of surprise that the lovers of chemistry have until now paid so little attention to the lavas ejected by volcanos at present in activity. With the exception of a few stray analyses of the lava of Vesuvius and Etna, we do not possess any further researches into this most interesting subject; and more especially are we in want of a series of chronicled results of comparisons between the ejecta of the same volcano at different periods, in order to determine whether there takes place in successive eruptions a constant increase or decrease of single components of the ejecta, whether the latter have essentially *the same* ingredients, and whether there does not exist some connection or relation between them.

With this view Dr. Genth, of Marburg, undertook a series of investigations on the matters ejected from Hecla at various periods, and with the following result:—

1. That the different kinds of lava ejected by Hecla differ essentially from the lava of Vesuvius and that of Etna, and most basalts and phonolites, by their not containing any component part that is soluble or becoming gelatinous in hydrochloric acid, but, with the exception of traces of magnetic iron, which may be extracted by hydrochloric acid, are insoluble in this acid;

2. That all lavas possess a single essential component part, which forms their fundamental substance, and that this principle component was the same composition as the wichtisite; and

3. That, if the component parts are not found in the same proportion as in the wichtisite, there may be separated in and around them other minerals, as the thjorsanit crysalite? orthaklas, magnetic iron, &c., which then, according to their different quantities, determine the difference of the analysis.

In order to show what differences there exist between the single components of the different species of lava, he made out the following table, in which he assumed every component of the lava of Háls* as unity, so as to compare the others with them:—

	Thjorsá.	Háls.	Efrah-vulshraun.	Lava of 1845.	Ashes of 1845.
$\dddot{S}i$	0.88	1 = 55.92	1.07	1.01	1.02
$\dddot{A}l$	1.12	1 = 15.08	1.10	0.99	0.94
$\dot{F}e$	0.79	1 = 15.18	0.75	0.92	0.88
$\dot{M}g$	1.79	1 = 4.21	0.57	0.97	0.96
$\dot{C}a$	1.99	1 = 6.54	0.85	0.98	0.95
$\dot{N}a$	0.49	1 = 2.51	1.43	1.37	0.94
$\dot{K}$	0.02	1 = 0.95	1.56	1.12	2.81
$\dot{R}$	1.26	1 = 7.730	0.81	0.99	0.98

In the subsequent table he assumed the oxygen of the silicic acid of the different species of lava to be *equal*, in order to make a comparison of their composition:—

CONTENTS OF OXYGEN.

	Of the silicic acid.	Alumina.	Of the bases R.
Thjorsá	= 10 :	3.01 :	3.33
Háls	= 10 :	2.38 :	2.61
Efrahvulshraun	= 10 :	2.44 :	1.97
Lava of 1845	= 10 :	2.32 :	2.54
Ashes of 1845	= 10 :	2.20 :	2.50

NEW METHOD OF ETCHING ON COPPER AND STEEL. BY DR. SCHWARZ, OF MERSEBURG, AND DR. R. BAHME, OF DRESDEN.

The method of etching on copper and steel, as practised till now, based itself on the use of the nitric acid, more or less diluted. The development of azote, which necessarily takes place during this process, has many disadvantages. The gas vesicles adhering to the metal, and protecting certain portions of it against the influence of the acid, render it necessary to attend to them constantly, and to remove them by means of a camel-hair brush, in order to prevent the etching from becoming unequal. The etching fluid has also a certain tendency (till now unexplained) of penetrating less deeply and corroding more the margins, so as to make it a difficult matter for the etching to become sufficiently deep whenever it is wanted to be particularly fine. Moreover, the large quantity of nitrous acid developed during the process became very injurious to the chest of the operator. It was, therefore, a very desirable object to discover etching fluids which would render the formation of vesicles impossible.

The simplest mode of obtaining this appeared to be to apply haloïds, which enter into direct affinity with the metals.

Experiments on a small scale gave the most satisfactory results, and the inventors, therefore, submit this method to further inquiry.

a. ETCHING FLUID FOR COPPER.

Take ten parts of fuming hydrochloric acid of commerce (containing forty per cent. of dry hydrochloric acid), and dilute them with seventy parts of water, and add thereto a boiling solution of two parts of chloride of potassium in twenty parts of water. A solution is thus obtained which contains a large quantity of what is called disposable chlorine. It may then be diluted with 100 or 200 parts of water, to etch therewith the more superficial portions; and by allowing the same a longer time to act, or by adding a stronger fluid, the deeper tones are produced. The slight smell of chlorine is not so unpleasant as the vapours of nitrous acid.

* A lava-stream of Hecla.

b. ETCHING FLUID FOR STEEL.

Take two parts of iodine and five parts of iodide of potassium, dissolve both in forty parts of water, by which the strongest fluid is obtained. This solution may again be diluted by forty parts of water to draw the finest lines. By waiting some time. or applying stronger fluid, deeper tones will be produced. The lines thus effected are very deep, and exceedingly sharp; the margins run quite straight, and even the finest lines drawn close to each other by a ruler do not flow together. The temperature is of little importance if it be of an ordinary degree, and, as the effect is slowly produced, hurry is unnecessary.

The fluid used once should not be thrown away, on account of the iodine being an expensive article, but a little carbonate of potash should be added, and the filtered fluid again made useful by the addition of some chlorine-water.

Should artists experience any difficulty in adopting this process, the discoverers are quite ready to give every desirable information.

REVIEWS.

The Sugar-Planter's Manual. By Dr. Evans.*
The Practical Sugar-Planter. By Leonard Wray.†

Few, very few, there are at this time, we will venture to predict, of the imaginative class who would do such violence to realities as to embody in either poem, drama, or novel the character of a rich West Indian uncle returning after years of profitable absence to shower down his wealth upon spendthrift nephews, poor cousins, or marriageable nieces. In Sheridan's time the conceit might pass; the thing might *not* have been of *too* frequent occurrence; but it could have happened without provoking a nine days' stare. Times have changed since then, and men and circumstances have changed too. The burning eloquence of Wilberforce achieved the abolition of human traffic; the sturdy argumentation of Buxton and his colleagues at length accomplished the rest. The flagellating overseer's post became extinct; whips fell to a remarkably low premium; negroes began to shade their faces from the sun by umbrellas, and to ride each morning to their work on mules; and last, though by no means least, in the first concatenation of circumstances, West Indian proprietors began to be ruined. This may be called the conclusion of the first act.

Now commenced a new state of things. The real West India proprietors, that is to say, those whose estates were unmortgaged, and were virtually as well as nominally in their own power—men who had prudently *not* spent their portion of the twenty millions compensation money—began to feel a laudable desire of improving the agriculture of their estates and the manufacture of their staple. Vague notions of the perfection of European science had come wafted to their ears—shoals of European sugar-boilers, and needy adventurers, inundated the islands. Schemes were tried that might have been pronounced *à priori* impracticable; strained comparisons were instituted between refinery and colonial operations; and appliances only suitable to the one were rashly transferred to the latter; liquor-pumps, steam-engines, boiling-pans of all constructions, mills of all forms, shapes, and sizes, were liberally provided; but all in vain. The sugar-cane juice unfortunately turned sour whilst the new-fangled operations were going on. Science so called now began to fall

* The Sugar-Planter's Manual, being a Treatise on the Art of obtaining Sugar from the Sugar-cane. By W. J. Evans, M.D.

† The Practical Sugar-Planter; a Complete Account of the Cultivation and Manufacture of the Sugar-cane according to the latest and most improved processes; describing and comparing the different systems pursued in the East and West Indies and the Straits of Malacca, and the relative expenses and advantages attendant upon each: being the result of sixteen years' actual experience as a sugar-planter in those countries. By Leonard Wray, Esq. 1 vol., 8vo., with numerous illustrations.

into contempt, and the speculative West Indian planters began to find that their share of the twenty millions had vanished to mortgage their estates to merchants at home, who, having ascertained the minimum production of the estates on which they were entered under the old process, protected themselves by repudiating any new experiments whatever, returned to the old system of working, and monopolized the whole convcyance of sugar from their estates almost on thcir own terms. This may be callcd the end of the second act in the West Indian drama.

The third commenced by a legislative enactment permitting the introduction of slave-grown sugar; thus undoubtedly giving an unfair advantage to the Brazilian, the Cuban, and the Dutch sugar-grower over our own West India proprietors. Thc enactment was a natural result of free trade; it was forced on Parliament by an external pressure which eould not be resisted, and will be productive, we entertain no doubt whatever, of ultimate good, as being onc step in the direction of universal free trade. There ean, however, be as little doubt that its immediate effect was most inimical to the West Indies, crushing the little energy which remained to the proprietors, annihilating their hopes, and, in short, consummating thcir long-threatened ruin. To this extent the West Indian drama has been played out, and it is well-nigh the end.

Things being now at their worst, we have authority for stating "they needs must mend;" and if the West India proprietors have a spark of hope left, and are not so thoroughly prostrate as their own turtles when backed on the sand, we may yet elicit from them a happy look by our assurance that better times are casting their shadows in advance.

The true theory of sugar-making has at length been indicated. The principle has been recognised that machines and mechanists can never accomplish the manufacture of good sugar from impure juices. The fact has been admitted that lime, now employed to accomplish a eertain purifieation of cane-juice, only does so at an expense of so large a portion of sugar destroyed that some other substance equally efficient at at least and less injurious *must* be found.

Thus, as physicians say, the diagnosis of the malady has been made out, and this is at least half way towards its cure.

Of the two volumes before us, that of Dr. Evans claims priority of notice for every reason. That it was the earlier published of the two is the least circumstance that should influence us, seeing that its lucid exposition of scientific doctrines and precise indication of things to be done give it precedence above all other books on thc same subject.

Much good, indeed, is already beginning to flow from the evil influence under which our West Indian colonies have groaned so long. The colonial sugar-maker eannot now, as of yore, afford to sacrifice between sixty and seventy per cent. of his material for the purpose of procuring the remainder in an impure form: the thing is as monstrous as negro slavery. A review of all other manufactures demonstrates it as a thing without analogy or alliance, but standing alone, a fit associate with the greatest social injustice the world has seen. We shall have occasion to advert to this topic hereafter, in treating of those parts of our author's books which bear directly on the subjects.

Once depart from the axioms of free trade, once introduce the principle of state protection for this interest or that, and injustice there must and will be. Whcn the West Indies were flourishing under protective duties, injustice was perpetrated on the taxed home population. Had the West Indian sugar-growers been long ago thrown on their own resources, had they stood in the position of the Manchester cotton-spinner or Sheffield eutler, they would have learned long ere this how perfectly monstrous was the idea, how unnatural the hope, that any manufacture could be perpetuated by means the most primitive, absent of all scientific alliances, and by forced labour from the suffering negro. Had the West India proprietor not been spoiled by the treacherous favours of a short-sighted Government, he would long ere this have become an intelligent chemical manufacturer, performing an intelligible manufacturing process: he would, at least, have known the theory of this art, would not have expected impossibilities, nor have ignorantly shut his eyes to possibilities. He would have cre this laid out the capital intended for ameliorating his manufacture definitely and rationally, and not cumbered his boiling-house by machines as foreign to the manufacture of sugar as flour-mills to cotton twist.

But the West Indians were the protected children of old protective Governments; accustomed to leading-strings, they eould not walk alone. Protection being suddenly withdrawn, the billows of free trade rolled over them, and now they are prostrate. Injustice, so inseparable from the principle of protection, was now felt in another direction. The Government, having bred its West Indian children in certain principles, was clearly responsible for not suddenly deserting them when other prineiples were thought expedient to be introduced. The West Indians have much to eomplain of on this head, and justly too, but the result could not have been prevented: interference with the principle of free trade was equivalent to an interference with a natural law. An amount of injustice was begotten—was distributed between the West Indian colonial proprietors and ourselves; the earlier period of the burden was ours, the last was theirs.

Dr. Evans, treating of the ehanged condition of thc West Indian colonies, says:—

"This unhappy change has elieited various opinions respecting its cause; and these opinions have necessarily influenced the views that have been taken of the future prospects of those dependencies, and of the measures to be adopted for their relief and improvement.

"For instance, we are often told by inconsiderate persons that the British sugar colonies are worn out, that they have become exhausted; that, as regards the fertility of their soil, &c., they are altogether inferior to the foreign possessions in their neighbourhood, and that no measurcs that ean be taken will enablc them to compete with those countries, which are not only more blest in this respect, but which, moreover, enjoy thc benefits of cheap labour.

"Another party, with a suffieient degree of self-complacency, resolves the explanation of 'West India distress' by the terms which are so often misused—'absenteeism and extravagance;' upon which they are accustomed to found charges of mismanagement against the entire body of proprietors.

"In answer to these assertions it may be sufficient to say, that so far from thc British West India eolonies being less fertile than other tropical countries, if wc may judge by the products per acre obtained from each, the reversc will be found to be the ease; and that, so far from their soil being worn out or exhausted, the heaviest crops have been and are usually obtained in those islands which have been under cultivation for the longest period—that is, in proportion to the agricultural knowledge displayed, and not to the newness of the soil.

"The general charges of absenteeism and extravagance, even if admitted to be general, would fail to explain the ehanges which have taken place, because it is well known that absenteeism prevailed, at least, to an equal cxtent formerly as it does at the present time; and that the same parties to whom extravagancc is imputed have realized large incomes from estates which now yield nothing.

"The West Indian proprietor, on the other hand, regards the measures which have been pursued towards those colonies since 1833 as the eauses of his present misfortunes. 'Nothing, he contends, has happened that might not have been confidently expected. During the period of slavery the want of labour was unknown, for the great majority of the population was compelled by law to work upon the plantations from day to day. But when that great social change, effected by the Emancipation Act, took place, vast numbers of thc freed people betook themselves to other occupations natural to a free community; many to desultory pursuits, squatting, and vagrancy; whilc those who continucd to work were, from the fewness of their number and the urgent necessity for their services, enabled to dictate their own terms to their employers. The colonies which suffered most from this cause endeavoured by every means in their power to eounteract its effects by the importation of labourers from abroad. But, instead of receiving assistance, their efforts were checked (in a quarter where they least expected) by the restrictive measures of the Home Government.'

"This statement is indisputably true. And there can be little doubt that, had the abolition of slave labour been simultaneously coupled with the measures which have since been adopted, and the enormous protection given to British sugars been taken away, the utter and entire ruin of those eolonies would have been long since consummated. As it was, many estates were immediately thrown out of eultivation, and the others continued to struggle on solely in consequence of the very high price which their produce yielded in the home market.

"These high prices, however, it was evident could not long be sustained, and, to relieve the consumer, foreign sugars, the growth of free labour, were admitted at greatly reduced duties. I do not think the West Indian had any reasonable cause of complaint against this measure. It had at least the merit of being consistent with those which had preceded it; and, had no restrietions at the same time existed upon the introduction of labourers into our own possessions, its operation would not have been felt by the planter.

"The object of the Sugar Duties Act of 1846 is the immediate reduction of duties upon all foreign sugars, and their prospective equalization in a very short period on all sugars indiscriminately, whether of British or foreign growth, or the produce of free or slave labour. This act professes to be based upon the principles of free trade, but its details show that it is very far from being so. It removes all protection from sugars the produce of British possessions; but it has not removed one single restriction imposed upon the grower. These may be stated to be as follow:—

"1st. Restrictions imposed upon the obtaining an increase of labour by immigration.

"The price of labour forms, indubitably, the most considerable item in the disbursements of a sugar estate in thc British West Indies; thc planter, thereforc, naturally regards it as the chief obstacle to his competition with his foreign rival. In the Spanish West Indian colonies, and in Brazil, not only does slavery exist, but, in spite of all our efforts to eheck it, the slave tradc continues. These, of themselves, it might be supposed, would be formidable advantages on thc side of the sugar-planter in those countries. But they are not the only ones he possesses. If he ehooses to employ free labour, he can obtain it where he pleases; he can import it under any flag; he is not restricted by any Passenger Act; and he can enter into arrangements, by contract or otherwise, with thc parties offering their services, either in the eountry whence they come, or in that where they are brought, without limitation of timc. From these eauses the Spanish planter could import labourers under a British flag, in an English vessel, at an ultimate cost of probably half that which is now paid in our own colonics.

"2d. Restrictions on the use of adequatc means to obtain both a larger amount of extract, and also one of better quality than is now effected."

Prostrate as thc Wcst Indian proprietors are, it is hardly consistent with a candid retrospeetion of the past for them to clamour so loudly in favour of protection. They ought to bc convinced, from the analogy of other manufactures, that a manful reliance on their own powers

would be a much better guarantee of their ultimate success.

That the protective system was indirectly injurious we have already seen; but it perpetuated a direct injury too. Thus witness a statment of our author:—

"Until a very recent period the planter was not permitted, in consequence of the fiscal regulations then in force, to import into this country sugar of a quality superior to that known as Muscovado.

"It is to this cause that we must attribute the imperfect mode of manufacture at present practised in the colonies; for how can we expect to find improvement when such effectual means are enforced to prevent it? Although the duties attached to sugars of different qualities have been greatly reduced they have not been equalized; and a very considerable protection is still kept up in favour of the refiner. This system of taxation is in the highest degree injudicious; for, to quote part of an address from M. Peligot to Admiral Duperré, formerly Minister of State for the French Colonies, 'it has been demonstrated that the sugar which pre-exists in the cane is white, and it is always so obtained when a part of it has not been destroyed. That the proportion which is obtained is consequently greater the less dark it is in colour.' And he asks, 'What ought to be thought of a legislative measure which imposes upon industry the exorbitant obligation of producing at the same time what is bad in quality and small in quantity, and which places a barrier before one of those things which the laws ought most to respect, progressive amelioration?'"

Dr. Evans apologizes in his preface for not touching on the subject of tropical agriculture, and for confining his attention exclusively to the manufacture. He need not have done this. Others, we will venture to say, would have done more justice to that subject than himself. He, as a chemical manufacturer, treating of a chemical manufacture, has not allowed his mind to wander from the one topic—in discussing which he has acquitted himself well.

The colonial sugar-planter, wedded to old customs and good old plans, should ponder over our author's introductory paragraph:—

"To prosecute with success any branch of art or manufacture, a knowledge of the principles on which the art or manufacture is based is indispensable. It will, I think, be admitted that, of two persons pursuing the same industrial occupation, the one who brings to his assistance an acquaintance with the laws by the operation of which the effects sought to be obtained are governed will possess advantages over the other, and that his efforts will present a greater chance of success.

"The object of the sugar-maker is that of separating from cane-juice, a fluid composed of a great variety of substances, one of its components, sugar, in the greatest abundance and most marketable form. This operation is essentially a chemical one, and, although it may not require that the person performing it should be a chemist in the full sense of the word, yet some acquaintance with that science would prove beneficial to him in many respects."

The chemical effects of heat and general impurities on sugar, so necessary to be well appreciated by the colonist as well as refiner, but which are generally so little understood, Dr. Evans clearly and succinctly explains. Sugar, being a crystalline substance, can only be practically crystallized out of the cane-juice containing it by first removing albuminous and other impurities from such juice; and secondly, evaporating by heat. The reactions which ensue are peculiar, but cannot be applied to sugar without destroying a portion, and effecting its conversion into certain dark compounds, many of them uncrystallizable; hence molasses and treacle, products, but not educts, obtained from sugar, but not existing in it:—

"If a solution of refined cane-sugar in water be exposed for a few hours to a temperature approaching 200°, the cane-sugar is converted into the sugar of fruits; if the experiment be continued the solution acquires a dark colour, and ultimately a dark brown powder falls, which does not possess sweetness; it is one of the substances which has been described as ulmine and ulmic acid. If glucose be similarly treated, but with the addition of a little lime, a similar precipitate, but of a still darker colour, is quickly induced. It is a combination of glucic and melasinic acid with the lime. The lime has acted as an oxidizing agent, and converted the glucose into glucic acid, with which it has immediately united, and by the prolonged action of this elevated temperature the glucic acid is converted into melasinic acid. The respective composition of these two bodies will enable us to understand the change which has been produced in the glucose. Glucic acid consists of carbon 8, hydrogen 5, oxygen 5; and melasinic acid of carbon 12, hydrogen 6, oxygen 5.

"If a little gluten, obtained from wheat, be placed in contact with a solution of cane-sugar, and the mixture be exposed to a moderately high temperature, it becomes viscid and mucilaginous; its sweetness disappears, and on examination gum will be found to have occupied the place of sugar.

"If a little curd, or a piece of animal membrane, or a small portion of gluten which has been preserved for a short time, be added to a solution similar to the above, the vinous fermentation will be established, the sugar, however, being previously converted into glucose by the action of these substances. It may be necessary to mention that, whenever this last-named change is produced in saccharine liquids, it is invariably accompanied with the development of myriads of minute cryptogamic plants, each individual of which consists of a simple nucleated cell. They are endowed with great fecundity, and continually increase in number until the fermentation is at its height. How far their existence may be essential to the development of this change is a question which has lately been much agitated, but which it is unnecessary for our purpose to discuss.

"The term fermentation has not been confined to this last-mentioned metamorphosis of saccharine substances, but has been applied equally to the others produced by the like class of causes. Thus the one in which the sugar is converted into gum has received the appellation of the viscous, and that in which the same body is converted into lactic acid has been denominated the lactic acid fermentation."

Here we have an epitome of the two grand indications which the sugar-manufacturer has to fulfil. The first is to purify the sugar containing liquor from all extraneous bodies; the second is to apply for the purpose of effecting evaporation as little heat as is consistent with practical exigencies. On the following out of these indications depends the whole success of the sugar manufacture.

These indications our author very properly reiterates again and again. Thus, at p. 29, we have a still further exposition of the changes effected on sugar by heat and impurities:—

"Cane-sugar, like all other organic substances, undergoes decomposition from slight disturbing causes. When pure, however, it is not prone to undergo any chemical change by mere exposure to the atmosphere; we have an instance in ordinary refined sugar, which may be kept for an indefinite period without alteration.

"A syrup obtained by dissolving two parts by weight of very pure cane-sugar in one part of water may be kept for some time without undergoing any change; but at length it acquires a somewhat dark colour, and a portion of it, by combining with the elements of water, is slowly converted into glucose. But if it be exposed to a temperature of 180° or 200°, either in a closed vessel or exposed to the atmosphere, this change is produced in a very few hours. If the syrup be exposed to this degree of heat for ninety hours it becomes black and acid, and a dark brown powder will be found at the bottom of the vessel.

"These changes are much expedited by the presence of an acid, even when its amount is very small; on the contrary, they are retarded by the presence of lime. But if the cane-sugar be not pure, if it be combined with glucose even in a minute quantity, lime has a contrary effect, and rather hastens than retards them.

"The explanation of these phenomena is as follows:—The sugar is first converted into glucose by combining with two atoms of water; this change is accelerated by the presence of an acid, which acts in the way formerly mentioned. The glucose in its turn is converted into glucic acid and melasinic acid. Lime or an alkali promotes this result, and when produced it immediately enters into combination with the newly formed acids. The composition of glucic acid is, as has been shown, C^8, H^5, O^5 = carbon 12 + 7.5 water; that of melasinic acid is C^{12}, H^6, O^5, = carbon 12 + 5 water + 1 hydrogen.

"These changes, therefore, are produced first by the addition to, and subsequently by the subtraction of, the elements of water from the original cane-sugar of the syrup."

Again, at p. 138, due prominence is given to the result of a most instructive experiment of M. Soubeiran, prefaced by a simple but pertinent appeal of the author to a phenomenon more often seen than reasoned on:—

"If we take a quantity of sugar, he remarks, in the state called crushed lumps, which is one of almost entire purity, and, after dissolving it in an equal weight of water so as to form a syrup, submit it to evaporation in a flat-bottomed copper pan over a naked fire, using the greatest care that the bottom of the pan alone be exposed to the fire, we shall perceive that little change takes place in its appearance at first, but in a short time, as the liquor approaches its granulating point, it gradually acquires a yellowish tint, which becomes deeper and assumes a reddish colour as the process continues. The same results are observed if, instead of an open fire, high-pressure steam be employed to effect the evaporation. In neither case, it is probable, has the temperature of the liquid exceeded 240°.

"In the 'Journal de Pharmacie' for 1842 will be found an account of some most interesting experiments made by M. Soubeiran, to illustrate the effect of heat on saccharine liquids. That gentleman exposed syrups to the action of heat in an apparatus so constructed that as evaporation went forward the water was returned to the sugar almost as soon as it was separated, and the uniform density of the liquid was consequently preserved. The changes produced in the sugar were tested by means of the polariscope, and the following results were observed:—

Syrup, primitive rotation		+68°
"	after 18 hours..	+54
"	" 48 " ..	+20
"	" 90 " ..	— 7
"	" 114 " ..	—16
"	" 138 " ..	— 6

"The syrup now became black and acid. It held suspended in it, and also deposited as a precipitate, a dark brown or black powder. The sugar was entirely decomposed. In another experiment the results were:—

Syrup, primitive rotation		+71°
"	after 18 hours..	— 8
"	" 36 " ..	—15

"The effects in this experiment were much more rapid, as the syrup was exposed to the heat of boiling muriate of lime.

"There is no necessity for presenting to the reader a detail of all the experiments performed. It will be sufficient to state, that each of them showed a result corresponding with the above.

"These results consisted,—1st. In the gradual disappearance of the cane-sugar. 2d. In its being replaced by glucose or the sugar of fruits. 3d. In the production of a black carbonaceous powder, and formic and acetic acids.

"It was also shown that these changes were prompt in direct ratio to the degree of heat which the syrup attained, and to the state of concentration of the latter.

"The presence of lime in pure syrup retarded

the changes, but, if only a very small quantity of glucose was found combined in the syrup, lime, on the other hand, tended rather to hasten them.

"M. Soubeiran next inqured," our author remarks," whether these changes took place during the process of refining Muscovado sugar. With this purpose he visited an establishment in the neighbourhood of Paris, in which the syrups were concentrated at a low temperature (*in vacuo*). He then discovered that by this treatment the syrup underwent no change, and that the glucose originally contained in the Muscovado sugar passed entirely into the treacle."

M. Soubeiran here was decidedly in the wrong. Even the heat of the vacuum-pan (from 135° to 140° F.) effects a certain though diminished amount of destruction; or else whence comes the treacle?

[*To be continued in our next.*]

Rose's Chemical Analysis, Qualitative and Quantitative. Translated by Dr. NORMANDY.*

Normandy's Practical Introduction to Rose's Chemical Analysis.†

It is a matter of pure supererogation to pass any comment on a treatise so well known by the force of its own intrinsic merits as the masterly treatise on chemical analysis by the Berlin philosopher. Anterior to the production of Fresenius it was, in fact, the only good book of its kind, and its value has been not in the least degree depreciated by the appearance of the former work, inasmuch as, the end proposed being identical, the paths for arriving at it chosen by the two authors in question are essentially different, each being so excellent in its way that a comparison of one with the other can invoke from a fair critic not one invidious remark.

The old English edition of Rose's "Chemistry," by Griffin, 1831, having become exceedingly scarce, and somewhat obsolete moreover, on account of the rapid advances which chemistry has made in latter years, such English readers as were not conversant with French or German experienced a difficulty in understanding the chemical literature of these languages, and were exposed to a most serious inconvenience. This has at length been removed by the recent translation now before us, and our chemical friends may now, although ignorant of French and German, study the profound volumes of Heinrich Rose.

Dr. Normandy apologizes in his preface for any peculiarities of expression which may be discovered in the translated volumes, pleading in excuse the difficulty attendant upon composition (to him) in a foreign language. Dr. Normandy may be easily excused on this point, seeing that the peculiarities of idiom are very few, and, where existant, not in the least obscuring the diction of the author. Indeed, the translator has executed his task well and faithfully, and the explanatory notes inserted by him in his editorial capacity are generally well worth their space, and deserving of association with the name of Heinrich Rose. This is no mean compliment.

A critical examination of the diction induces us to believe that Dr. Normandy, in effecting his translation, availed himself pretty largely of the facilities of his mother tongue, and appealed with more frequency to the French than to the German edition. Under the circumstances this is a matter of very trifling import, inasmuch as the French edition preserved most faithfully the form and spirit of the original. Moreover, it contains many valuable notes by Peligot, which are here reprinted. We have, however, one slight regret to express, which is this:—The translator has invariably given the French synonyms of English terms, but has omitted to append the German ones. This is ill-advised. The French, like ourselves, owing to some want of constructiveness in their language, were obliged to have recourse to the Latin and Greek for the purpose of forming their nomenclature, and hence the chemical terms vary exceedingly little for either language. The Germans, however, followed another plan. Less hampered than their neighbours by difficulties of adapting their mother tongue to the forging of new words, the German chemical nomenclature is essentially Teutonic. Thus, whilst very few English chemists, however ignorant of French, would require to be told that the words *acide sulfurique* and *sulphuric acid* were synonyms, they might ponder a long time over the Teutonic appellation *schwefelsaure* without arriving at a similar conclusion. This omission we consider one of some little consequence to a numerous class of chemical readers, and should be remedied whenever another edition is demanded.

We have already testified to the value of the translation of the notes of M. Peligot to the French edition of Rose's "Chemistry;" but the reader shall judge for himself. For this purpose we will select the note on arsenic at page 362 of vol. i.:—

"'Since the publishing of this work' (*i. e.*, the French edition), 'the researches on poisoning by arsenic have been the subject of numerous and important investigations. Soon after a trial, which has engaged public attention in the highest degree,* several French chemists have most carefully investigated and discussed the relative advantages and defects of the various methods hitherto employed in chemico-legal analyses, and have been led either to propose new processes altogether, or else radically to modify the processes already known and in use for the detection of this dread substance.'

"These labours, which have had the benefit of contradictory debates, were submitted to the judgment of the Royal Academy of Sciences of Paris; and a committee, composed of Messrs. Thénard, Dumas, Boussingault, and Regnault, was entrusted with their examination. This committee undertook also a long and elaborate series of experiments, with a view to solve the principal questions referring to the detection of arsenic in medico-legal researches; and the report which M. Regnault made in the name of the said committee should be taken as a guide by those chemists who may be called upon to undertake the difficult task of investigating cases of poisoning by this substance.

"Although several of the processes recommended by the French chemists and the committee of the Royal Institute have been already mentioned in the preceding pages, we have thought it advisable to reproduce these processes in the present additional note, in order to preserve to the experiments the character of completeness, which, in our opinion, contributes to enhance their value and importance.

"In cases of poisoning by arsenious acid the research of this substance may be divided into three principal operations:—

"1. The concentration of the poisonous substance by means of the destruction of the animal substances with which it is associated.

"2. The volatilization of the poisonous body by means of Marsh's improved apparatus.

"3. The examination of the volatilized product and the demonstration of the principal characteristics of arsenic.

"Each of these operations being of paramount importance requires the minutest care. If the product submitted to analytical research has not been properly prepared, if, for example, the suspected animal matter has not been entirely destroyed, the apparatus of Marsh, even though the said suspected animal matter should contain no arsenic, will show signs which may lead an inexperienced chemist into error; or, if the said matter really contains arsenic, these signs will be so complicated as actually to render the presence of the poison doubtful.

"If, on the other hand, the substance under examination contains antimony, iron, mercury, these metals when treated by Marsh's apparatus will stimulate the reaction of arsenic, which renders it absolutely necessary to submit the spots or rings or mirrors produced by the apparatus to an attentive examination, with a view to ascertain their true nature. The production of these spots or rings, which may likewise result from the imperfect combustion of the products under test, must be looked upon at most only as probable signs of the presence of arsenic, but are altogether insufficient, and cannot in any case whatever be received as positive proofs of the presence of arsenic.

"The process for the concentration of the poisonous substance must be such that the whole of this substance, even though the quantity contained in the animal matter be very small, should as much as possible be preserved. 'If,' says the report of the Academy of Sciences, 'the analyst most generally can detect arsenic with facility in the poisoned food, or in the vomited matter, or, lastly, in the excrement found in the intestines, cases occur in which all these substances are wanting, and in which the poison must be sought for in the body, in the tissues by which it has been absorbed. Such cases will present themselves, especially in corpses which have been buried, and which may have thus sojourned a certain lapse of time in the ground.'

"M. Orfila has ascertained by numerous experiments that arsenious acid may be detected after death in the blood, in the viscera, and in the urine.

"'In order to separate the arsenic which has been thus absorbed, the organic matter should be boiled for several hours in water, and yet this separation cannot be effected in a complete manner. The liquid thus obtained by boiling contains a large proportion of organic matter in solution, and produces, with Marsh's apparatus, such a voluminous froth that it is impossible to make use of it in a direct manner; it is absolutely necessary to destroy the organic matter in the solution, but in such a way as not to lose any of the arsenious acid.

"'M. Orfila proposed two methods for effecting this.

"'The first consists in burning the organic matter by nitre, and consequently thus to convert the arsenic it may contain into arseniate of potash. The *modus operandi* is as follows:—

"'If the substance to be analyzed be a liquid, urine for example, nitrate of potash is to be dissolved therein, and the whole evaporated to dryness, taking care to stir all the time, so as to obtain a homogeneous mass.

"'If the matter be pasty or solid, such as the liver, the spleen, muscular flesh, &c., it is to be cut and bruised in a porcelain or glass mortar, with about double its weight of nitre, the mixture being thus reduced into a thick paste, in which the nitrate of potash is evenly disseminated, and it is to be dried by a gentle heat in a porcelain capsula.

"'This operation being terminated, a new hessian crucible is to be brought to a dark-red heat, into which the organic matter, mingled with nitre, as above, must be introdueed by small portions at a time.

"'If, as soon as the first portion thrown in the crucible has deflagrated, the product of the combustion, instead of being white or greyish, on the contrary remains black and carbonaceous, this colour indicates that the quantity of nitre employed is insufficient to effect the complete combustion of the animal matter, and therefore a fresh portion of nitre must be added in order to effect this perfect or complete combustion.

"'When all the mass has deflagrated, the product remains in the crucible in the fused state; the crucible is then to be withdrawn, and when it has cooled down, so that the substance therein has acquired a pasty consistence, a small quantity of distilled water is added, in order to dilute the mass so as to pour it in a porcelain capsula. If a portion of the saline mass adheres to the crucible, it may be detached by boiling in it a

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* A Practical Treatise of Chemical Analysis, including Tables for Calculation in Analysis. By H. Rose. Translated from the French and from the Fourth German Edition. With Notes and Additions by A. Normandy.

† Practical Introduction to H. Rose's Treatise on Chemical Analysis. Illustrated by Synoptic Tables and numerous Formulas. By A. Normandy.

* That of Madame Laffarge.

small quantity of water, which is to be added to that in the porcelain capsula.

" 'The saline mass is next to be decomposed by a slight excess of sulphuric acid added in small portions at a time, and the whole must be evaporated so as to expel entirely the nitrous and nitric acids, the presence of which would prevent the disengagement of hydrogen when treating the matter by Marsh's apparatus, and might even cause an explosion.

" 'Lastly, the saline residuum being treated again by water, the solution thus obtained is introduced in Marsh's apparatus.

" 'The second process indicated by M. Orfila consists in treating the aqueous decoctions of the viscera by pure nitric acid, evaporating to dryness in order to char the animal matter, treating the charcoal by boiling water, and testing the liquor by Marsh's apparatus. The operator may also, and it is this last process which is preferred by Orfila, carbonize directly the organs under examination by nitric acid. To effect this the viscera are first to be cut into small pieces and dried, and then thrown by small portions at a time into a porcelain capsula containing hot nitric acid. An abundant disengagement of nitrous acid fumes soon takes place, and shortly afterwards the fragments of organic matter are dissolved. When all the organic matter has thus been put in the capsula the evaporation is to be continued until the thickened mass emits all of a sudden a thick smoke. The capsula must then be immediately removed from the fire, and the carbonization is spontaneously completed. Should the capsula be suffered to remain longer on the fire a very vivid deflagration would ordinarily take place, which would create a notable loss of arsenic. The charcoal thus obtained must be pulverized in a glass mortar, and boiled several times with distilled water, and the liquor is tested by Marsh's apparatus. When the charring has been carefully effected the liquor is limpid and does not froth up, but if the carbonization is complete, if the charcoal resulting therefrom be greasy, the liquor obtained contains more or less organic matter, and when treated by Marsh's apparatus it froths up.

" 'The charring by means of nitric acid is inconvenient, because to effect this a large quantity of acid is required ; but a drawback of a much more serious kind, and which it is often impossible to avoid even by the most careful watching, is the very vivid deflagration which may take place towards the end of the operation, and by which the greatest part of the arsenic may be volatilized.'*

" A third method has been proposed by Messrs. Flandin and Danger ; this method is as follows :—The portion of the viscus or of the flesh which is intended for examination must be cut into small pieces, which are to be put in a porcelain capsula, and drenched with one sixth or a quarter of its weight of pure concentrated sulphuric acid. The proportion of sulphuric acid to be employed is dependent on the state of the animal matter ; the fresher it is, the larger must be the proportion of sulphuric acid.

" The capsula being placed on the fire, the animal matter soon becomes liquefied and transformed into a black semi-fluid mass, which must be stirred all the while with a glass rod. When the matter has thus liquefied, and, in order to avoid projection, pieces of ignited charcoal are placed all round, so as to heat the edges of the capsula, the treatment is to be continued until the matter has acquired sufficient consistence, so that all danger of intumescence or projection is over. The heat is then to be increased, so as to heat the capsula in an equable manner, until complete evaporation of the liquid.

" If the charcoal resulting from the operation is dry and brittle, it is a sign that the charring is as it should be, and that the quantity of sulphuric acid employed was sufficient. If, on the contrary, the charcoal obtained is greasy and cannot be readily pulverized, the capsula must be withdrawn from the fire, left to cool for some little time, drenched with a fresh portion of sulphuric acid, and heated again until vapours are no longer disengaged, and the charcoal has become dry and brittle.

" The capsula is now to be withdrawn from the fire and suffered to cool ; the charcoal is next to be pulverized with a glass pestle and moistened with aqua regia, composed of three parts of nitric acid and one part of muriatic acid : both these acids must be pure and concentrated. By this addition of aqua regia the arsenious is converted into arsenic acid, which is much more soluble. Heat is to be again applied, stirring all the while until the charcoal has become dry. In this state it is to be treated by boiling water, and the liquor, which is quite limpid, and sometimes colourless, is introduced into Marsh's apparatus, in which it never produces any froth. 'This process,' continues the report of the committee of the Academy of Sciences, 'is much preferable to the carbonizing by means of nitric acid ; the operation is more easily controlled ; a less quantity of the reagents is required (which is a very important consideration), and deflagration never takes place. And we have ascertained, by a great number of experiments, that by operating by this process upon two or three hundred grammes (about thirty or forty thousand English grains) of muscular flesh, to which only one milligramme (0.0154 gr.) of arsenious acid had been added, spots of arsenic were obtained, upon which all the characteristic reactions of arsenic could be demonstrated.'

" This process, though simple and extremely delicate, rests, however, upon reactions, attended also with certain drawbacks which it is important to point out. If in effect the methods employed in chemico-legal analyses should be such as to leave no doubt as to the real nature of the poisonous substance separated, it is equally necessary that these methods, when in sufficiently skilful hands, should not cause the substances, for the separation of which they are employed, to be destroyed or dissipated. Now, the above process by sulphuric acid, as described, does not fulfil the latter condition, for it may cause the volatilization, and subsequently a loss of arsenic more or less considerable.

" The necessity in which the operator is placed of eliminating at the end of the operation the excess of sulphuric acid requires a temperature sufficiently elevated, at least in some cases, to reduce the arsenious acid in contact with the charcoal produced by the animal matter, and to volatilize either the liberated arsenic, or else the undecomposed arsenious acid ; the vapours of sulphuric acid must render this volatilization still more easy.

" It does not seem possible to manage the heat as completely to avoid all chance of loss, though this danger is much diminished when in the hands of chemists well versed in the manipulation of the process ; but it must be admitted that, generally speaking, the necessity of obtaining a dry and brittle charcoal will lead, at least in some cases, to heating the mass to a temperature which may prove sufficiently high to volatilize all the arsenic. A process, therefore, which, in a theoretical point of view, presents this inconvenience furnishes results which are conclusive when positive, but doubtful or uncertain when negative.

" At any rate, this process requires to be modified, as was proposed by the committee of the Royal Institute, by effecting the carbonization, not in an open capsula, but in a retort provided with a receiver. The charcoal which is left in the retort must be well pulverized, and treated by a little nitric acid, dried again, treated by boiling water, and the liquid which may have distilled in the receiver is to be added thereto.

" And, further, if the substance to be carbonized contains chlorides, it is to be feared that the arsenic may be carried away in the state of chloride of arsenic during the decomposition by sulphuric acid, or subsequently during the treatment of the charcoal by aqua regia ; the arsenic, however, may be arrested whilst carbonizing in a retort, provided with a receiver, the inside of which must be previously moistened with water.

" Lastly, this process has another inconvenience, namely, as it is almost impossible that the sulphuric charcoal which remains after carbonization should not contain sulphurous acid, the solution which contains it being introduced in Marsh's apparatus determines the separation of the arsenic in the state of sulphuret of arsenic, and necessitates a modification of the processes employed for the identification of this body when obtained in the metallic state.

" To resume : the analyst has the choice between two methods of combustion ; the one by sulphuric acid, the other by nitre. The latter, when well executed, appears preferable, the arsenic forming then a non-volatile combination (arseniate of potash) ; the danger of loss of this body must be less than that by the process of carbonization by sulphuric acid. If, however, it be apprehended that some part of the mixture of nitre with the matter to be burnt, which mixture can never be perfectly intimate, if, we repeat it, there is reason to apprehend that this mixture should be acted upon by the heat before the reaction of the nitre takes place, which would cause a portion of the arsenic to disappear, this mixture may be further mingled with three or four times its weight of dry carbonate of soda, the object of this addition being to render the deflagration less rapid, and to produce the fusion and consequently the contact of the substances in the mixture before the combustion of the animal matter takes place. This process, it is true, has the drawback of introducing in the analysis a somewhat larger number of chemical reagents ; but this inconvenience disappears if the analyst takes care, as he always should before submitting the analysis to the last and definitive test in Marsh's apparatus, to make a blanc assay of all the substances which he employs.

" In effecting the combustion of the organic matter by means of nitre, as has been related above, but without addition of carbonate of soda, the committee of the Academy of Medicine, who undertook also an important series of researches upon arsenic, in a medico-legal point of view, obtained, according to M. Caventou, who wrote the report, results which were generally of a more clear and decisive kind than by the carbonization by means of sulphuric acid.

" When the animal substances in which the presence of arsenic is suspected have been destroyed, the poison must be tested for by means of Marsh's improved apparatus.

" This apparatus, as first used and improved by Liebig and Berzelius, has been already described ; therefore all that is necessary now is to point out here the further modifications which have been made to it.

" It is known that, when hydrogen gas is disengaged from a liquor which holds in solution an arsenical compound soluble in water, this gas is associated with a certain proportion of arseniuretted hydrogen gas, the presence of which may be immediately recognised by the following characters.

" 1st. Its being decomposed by heat. If the gas be passed through a glass tube heated to a dark red, the arseniuretted hydrogen is decomposed into hydrogen gas, which is disengaged, and metallic arsenic, which condenses under the form of a ring at a certain distance from the part of the tube which is exposed to the action of the heat.

" 2d. Its incomplete combustion in the air. The jet of hydrogen gas mixed with arseniuretted hydrogen being kindled, the element more combustible than the other (namely, the hydrogen) burns first ; so that, if a cold substance (for example, a piece of china) be introduced into the flame, the arsenic condenses upon it in the metallic state, forming shining spots of a dark brown colour.

" By means of Marsh's apparatus these properties of arseniuretted hydrogen may be exhibited. The formation of the metallic ring must be preferred to the production of spots, for the greatest part of the volatilized arsenic

* Extracted from the report of the committee of the Royal Institute.

may thus be assembled in one point, and quantities of arsenic which could not be perceived by means of spots, or if so in a doubtful manner, are rendered perfectly visible, when tried for the production of the ring. Wherefore the committee of the Institute has given the preference to an apparatus by which the arsenic may be isolated in the shape of a metallic ring."

Again, under the head of carbon, page 529, vol. ii., we find another admirable note on some methods of discovering the amount of carbon in iron. The first is a plan of M. Fuchs, and consists :—

"in treating this metal, steel or cast iron, by a solution of perchloride of iron, the excess of acid of which has been previously saturated with marble. The iron dissolves, and the perchloride of iron is converted into protochloride of iron; a sediment consisting of peroxide of iron, mixed with charcoal, is at the same time precipitated, which must be treated separately by muriatic acid. This method is a modification of that of Berzelius, which consists in treating the carbonaceous iron by protochloride of copper (*chlorure cuivrique*). The advantage of this method, according to Berzelius, is that the operation can be more readily followed, and that it produces peroxide of iron, which is, perhaps, more easy to separate from the charcoal than copper.

"M. Regnault proposed *another method* for the easy and accurate determination of the carbon contained in cast iron. Five grammes of cast iron reduced into filings, when it is soft, or pulverized into a mortar when it is brittle, are mixed with sixty or eighty grammes of chromate of lead, previously fused, one third or one fourth of which mixture is set aside. Five grammes of chlorate of potash are then added to the remainder, which chlorate of potash contains about the quantity of oxygen necessary to convert the iron into peroxide; and the mixture is introduced into a glass tube, similar to those employed in organic analysis, but which may be much shorter. The portion of the mixture of cast iron and of chromate of lead, which was set aside, is now added and put over the other portion in the tube, and lastly, an exsiccating apparatus, and a Liebig's apparatus for condensing carbonic acid, is adapted to the tube as for performing an organic analysis. The portion of the tube which contains the mixture without chlorate is brought to a red heat, and, when this is done, the operator begins to heat the portion which contains the other mixture with the chlorate, and the heat is gradually advanced in proportion as the disengagement of the gas becomes slower. By operating thus, the cast iron is first burnt almost completely by the oxygen of the chlorate, and only a very small quantity of this gas escapes from the tube. The temperature then becoming higher, the combustion is finished by the chromate of lead which in fusing oxidizes the last portion of the cast iron. It is advisable to wrap the glass tube in a sheet of copper, because, towards the end, the heat must be strong enough to fuse the chromate of lead completely.

"The oxidization of the cast iron is complete, which may be ascertained by triturating the mass contained in the tube after the combustion, when it will be seen that not a particle remains capable of being attracted by a magnet. The analysis is besides so easily performed that it may be completed in less than half an hour."

We have extracted the foregoing long portions of Peligot's addition to the French edition of Rose's work in order that the reader may judge favourably of Dr. Normandy's editorial discrimination. To extract any portion of the translation of the original treatise that should do justice to the author's views would be impossible. The two volumes should be in the possession of every individual who is occupied by chemical inquiries.

Hitherto Dr. Normandy has come under our notice as a translator. We have now to regard him as an original author in connection with his "Introduction to Rose's Chemistry," a work which, having looked carefully through, we can honestly pronounce admirable in all respects except its name. It bears a similar relation to Rose's treatise that a condensed algebraical formula does to the equivalent expression expanded in full, being, in point of fact, a series of tabular views of chemical reagencies to be seen in the concrete, and contemplated at a glance. As a practical introduction to Rose's treatise, Dr. Normandy's book is unintelligible, but it is nevertheless a remarkably useful work. Chapter xiii., which sets forth a summary process for detecting the genus of salts, we consider to be the result of a very happy idea. In chemistry, as well as more ordinary affairs, ninety-nine per cent. of any truth will often serve for most ends, and some offhand mode of acquiring this amount without much exercise of delicacy or refinement or expenditure of time is often a desideratum :—

"The genus of a salt," our author states, "may generally be determined by a few simple experiments, and, although we have given before a comprehensive course of operations, by means of which the same object may be attained by a systematical analysis of the substance, yet the following table may be found useful for the purpose of summarily ascertaining to what generic class a given salt may belong :—

A.

"Pour some sulphuric acid upon a portion of the salt under examination, and, if the salt thus treated by sulphuric acid produces an effervescence, a gas being thus disengaged, see B. *a*.

"(*a*). The salt may be a

Carbonate, Sesquicarbonate, Bicarbonate, Chlorate, Perchlorate, Nitrate, Nitrite, Sulphite, Hyposulphite, } or a { Chloride, Iodide, Bromide, Fluoride, Cyanide, } or a { Sulphuret, Seleniuret.

"If the salt thus treated by sulphuric acid does not effervesce, nor disengage any gas at the ordinary temperature, see ..... R. *b*.

"(*b*). The salt may be an

Arseniate,	Phosphate,	Silicate,
Borate,	Phosphite,	Sulphate,
Bromate,	Hypophosphite,	Hyposulphate.
Iodate	Seleniate,	
Oxalate,	Selenite,	

B.

"If the gas disengaged from the salt treated by sulphuric acid (A. *a*.) has colour, see .. C. *c*.

"(*c*). The salt may be a

Chlorate, Nitrite, } or an { Iodide, Bromide.

"If the gas evolved from the salt treated by sulphuric acid (A. *a*.) is colourless, see .. F. *d*.

"(*d*). The salt may be an

Arsenite, Antimoniate, Antimonite, Carbonate, Bicarbonate, Sesquicarbonate, Chromate, Molybdate, Nitrate, Perchlorate, Sulphite, Hyposulphite, Tantalate, Titanate, Tungstate, Vanadate, } or a { Chloride, Cyanide, Fluoride, Sulphuret, Seleniuret.

C.

"If a portion of the salt, being thrown upon ignited charcoal, activate the combustion thereof, more or less, see ..... D. *e*.

"(*e*). The salt may be a

Chlorate,
Nitrite,
Seleniate.

"If a portion of the salt, being thrown upon ignited charcoal, does not activate the combustion thereof, see ..... E. *f*.

"(*f*). The salt may be an

Iodide,
Bromide.

D.

"If the salt, being mixed with a combustible substance, such as sulphur, charcoal, sawdust, phosphorus, &c., detonates violently when struck with a hammer, it is a ..... Chlorate. *g*.

"If the salt, being mixed with combustible substances, as said above (D. *g*.), and then struck with a hammer, does not detonate, and provided it has emitted ruddy fumes of nitrous acid when treated by sulphuric acid, as said before (B. *c*.), it is a..... Nitrite. *h*.

E.

"If the salt, being dissolved, its solution, when treated by aqueous chlorine, deposits a brown powder, which powder emits vapours of a violet colour when heated, it is an.. Iodide. *i*.

"If the solution of the salt, being treated by aqueous chlorine, assumes a reddish-yellow colour, but forms no precipitate, and exhales a strong odour of bromine, it is a .. Bromide. *j*.

F.

"If the gas disengaged from the salt, which has been treated by sulphuric acid (B. *d*.), is in the shape of white pungent fumes, more or less thick, see..... G. *k*.

"(*k*). The salt may be a

Nitrate, Perchlorate, } or { Chloride, Fluoride.

"If the gas disengaged from the salt, treated by sulphuric acid (B. *d*.), is invisible in the air, see ..... J. *l*.

"(*l*). The salt may be a

Carbonate, Bicarbonate, Sesquicarbonate, Sulphite, Hyposulphite, } or a { Cyanide, Seleniuret, Sulphuret.

G.

"If the white pungent fumes disengaged from the salt, treated by sulphuric acid (B. *d*.), corrode glass, it is a ..... Fluoride. *m*.

"If the fumes disengaged from the salt treated by sulphuric acid (B. *d*.) have no action upon glass, see ..... H. *n*.

"(*n*). The salt may be a

Nitrate,
or a
Perchlorate,
or a
Chloride.

H.

"If the salt previously mixed with peroxide of manganese is treated in the cold by sulphuric acid, and emits then a greenish-yellow gas having the odour of chlorine, it is a..... Chloride. *o*.

"If the salt, being treated in the same manner as just said, does not disengage chlorine, see I. *p*.

"(*p*). The salt may be a

Nitrate,
or a
Perchlorate.

I.

"If the salt, previously mixed with copper filings and then treated with sulphuric acid, either in the cold or by a gentle heat, disengages ruddy vapours of nitrous acid, it is a Nitrate. *q*.

"If the salt, treated in the same way, does not disengage ruddy fumes of nitrous acid, it is a ..... Perchlorate. *r*.

J.

"If the solution of the salt, being tested by solution of salts of lead, of copper, of mercury, of silver, produces a black precipitate, see K. *s*.

"(*s*). The salt may be a

Seleniuret,
or a
Sulphuret.

"If the salt tested with these metallic solutions produces no black precipitate, see..M. *t*.

"(*t*). The salt may be a

Carbonate, Sesquicarbonate, Bicarbonate, Sulphite, Hyposulphite, } or a Cyanide.

K.

"If the salt forms a colourless solution, which, when treated in that state by acid, disengages a gas of a fetid odour (sulphuretted hydrogen), the solution remaing transparent, see ..... L. *u*.

"(*u*). The salt may be a

Seleniuret,
or a
Sulphuret.

"If the salt forms a solution of a reddish-yellow colour, which disengages sulphuretted hydrogen gas, when treated by an acid, a yellowish-white precipitate of sulphur being at the same time produced, it is a

Sulphuret. *v*. (in maximum of sulphur).

L.

"If the salt forms a colourless solution, which, when treated by nitrous acid, or chlorine, deposits a yellowish-white powder of sulphur, it is a ..... Sulphuret (simple). *w*.

"If the solution of the salt, being treated by nitric acid, or by chlorine, does not deposit a yellowish-white powder of sulphur, it contains Selcniurets. *x*.

M.

"If the salt, being treated by a strong acid, emits an odour of bitter almonds, and if its solution produces, with nitrate of silver, a white precipitate insoluble in cold nitric acid, soluble in ammonia, it is a..... Cyanide. *y*.

"If the salt, when treated by a powerful acid, does not evolve a gas having the odour of bitter almonds, and if its solution is not precipitated by nitrate of silver, or if the precipitate produced is soluble in cold nitric acid, see..... N. *z*.

"(*z*). The salt may be a

Carbonate,	Sulphite,
Sesquicarbonate,	Hyposulphite.
Bicarbonate,	

N.

"If the salt, when treated by acids, disengages a gas which extinguishes a lighted taper plunged in it, and which forms a white precipitate with lime-water, see..... O. *a'*.

"(*a'*). The salt may be a

Carbonate,
Sesquicarbonate.
Bicarbonate.

"If the salt, when treated by acids, disengages a gas which has the odour of burning sulphur, (sulphurous acid), which extinguishes a lighted taper plunged therein, but forms no precipitate with lime-water, see..... Q. *b'*.

"(*b'*). The salt may be a

Sulphite,
or a
Hyposulphite.

O.

"If the solution of the salt produces a white precipitate when treated by a solution of sulphate of magnesia at the ordinary temperature, it is a..... Carbonate. *c*.

"If the solution of the salt produces no precipitate when treated by the solution of sulphate of magnesia at the ordinary temperature, see P. *d'*.

"(*d'*). The salt may be a

Bicarbonate,
or a
Sesquicarbonate.

P.

"If the solution of the salt is precipitated by lime or baryta-water or by solutions of salts of lead or of copper with effervescence, it is a Bicarbonate. *e'*.

"If the solution of the salt is precipitated by lime and baryta-water, and by solutions of salts of lead, but does not sensibly effervesce in so doing, it is a..... Sesquicarbonate. *f'*.

Q.

"If the solution of the salt effervesces when treated by acids, and disengages sulphurous acid whilst the solution remains clear, it is a Sulphite. *g'*.

"If the solution of the salt, when treated by acids, effervesces, and disengages sulphurous acid, but forms at the same time a yellowish-white deposit of sulphur, it is a Hyposulphite. *h'*.

R.

"If the salt, being treated by sulphuric acid, has emitted coloured fumes, see..... S. *i'*.

"(*i'*). The salt may be a

Bromate,
or an
Iodate.

"If the salt, being treated by sulphuric acid, does not evolve coloured fumes, see..... T. *j'*.

"(*j'*). The salt may be an

Antimoniate,	Hypophosphite,
Antimonite,	Seleniate,
Arseniate,	Selenite,
Arsenite,	Silicate,
Borate,	Sulphate,
Chromate,	Hyposulphate,
Molybdate,	Tantalate,
Oxalate,	Titanate.
Phosphate,	Tungstate,
Phosphite,	Vanadate.

S.

"If the salt, being treated by sulphuric acid, disengages, with the help of heat, reddish-brown vapours, condensing to a liquid of the same colour, the salt is a ..... Bromate. *k'*.

"If the salt, being treated by sulphuric acid, disengages, with the help of heat, violet vapours, which condense into small shining greyish spangles, it is an ..... Iodate. *l'*.

T.

"If the salt, having an alkali for a base, fuses easily into a limpid glass, see..... U. *m'*.

"(*m'*). The salt may be an

Arseniate,	Phosphate,
Borate,	Silicate.

"If the salt, having an alkali for a base, is either infusible or decomposed by heat, or, if fusible, does not produce a limpid transparent glass, see ..... X. *n'*.

"(*n'*). The salt may be an

Arsenite,	Seleniate,
Antimoniate,	Selenite,
Antimonite,	Hyposulphate,
Chromate,	Sulphate,
Molybdate,	Tantalate,
Oxalate,	Titanate,
Phosphite,	Tungstate,
Hypophosphite,	Vanadate."

From the portion of the chapter which we have transferred to our pages the chemical reader will be able to judge of the utility of our author's summary process.

Our pleasure from the consideration of the chapter is so great that we will not stop to point out (except most rapidly) some words which are not quite English, although so nearly like it that we understood without difficulty the meaning. *Capsule* is more English than *capsula*, and the term *activate* we do not remember to have seen before, but it is now admixed with associations so little unpleasing to us that some day we may find it tripping unconsciously from our own pen.

Other duties must now call us from a further consideration of Dr. Normandy's literary labours. We beg to congratulate him on the felicitous achievement of his task, and hope he may before long be introduced to us again on an occasion most pleasing to every author—the occasion of a new edition.

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 11, 1848.

THE NEW CURRICULUM OF STUDY AT CAMBRIDGE.

Most of our readers will doubtless have heard of a certain eccentric gentleman of Hellenic fame denominated Procrustes,—an individual who, although possessed of highly-elaborated notions of adaptation, accomplished his object by a course more summary than it was considerate or agrecable. How he studied the comfort of his guests, by adapting their respective lengths to the length of his iron bed, is well known. Fortunate, indeed, was the guest whose length of limb exactly accorded with that of the iron frame; *he* might sleep and be comfortable; but very little of comfort, we presume, could there have been for those whose legs might happen to have been either too short or too long for the iron standard. To be extended a few inches in the former case, or amputated to the same amount in the latter, could have been no joke.

The conceit of Procrustes is not so extraordinary after all; a similar feat has up to the present time been attempted by our two ancient universities; and, if Cambridge has taken the initiative in arranging a better order of things, the revolution has been accomplished so tardily, and with so little display of cordiality by the members of the Senate, as to warrant one in believing that the change, though effected, was the result of pressure from without rather than from an internal consciousness of the absurdity of the university curriculum.

Nature has diversified the character and leaning of the human mind no less than external lineaments of form and figure. One individual will possess a tendency to acquire a refined mathematical education—another will prefer the study of languages—another will avail himself of all opportunities to dive into the arcana of physical or chemical truths—and a fourth will be qualifying himself, by the study of political science, to take part in the multifarious legislative duties in which he may be hereafter likely to play a prominent part. Either of these subjects surely forms an ample supply of materials for study by which to test the power of a mind, by which to award a fit academic recompense, or a passport through the carcer of dawning manhood.

To have insisted, like the Cambridge Senate, until lately, that all minds should train themselves to one iron standard of comparison—that all honours from that university should only be awarded through the mathematical portal—was little more than a re-enactment of the Procrustean tyranny.

And now that Cambridge has tardily acknowledged her error, and has published a more extensive curriculum of subjects to be honoured and taught, we will venture to express a hope that the affectation of pure abstraction, an affectation to which mathematicians are prone, may not hover over and oppress those new branches of knowledge to which Cambridge has at length thrown open her gates. Although human nature in the abstract be defiled and base, and science be the emanation of God—a pure effulgence of truth—yet he who, being human, thinks it beneath him to apply science to the amelioration of his race, fulfils but half his mission in this world, and will have a grave sin to account for hereafter.

Whatever good opinion the Cambridge Senate may have entertained on the propriety of the studied abstraction from all earthly uses which they accomplished for their mathematical course, this opinion is one which has not, for a long time, been sealed by the approbation of the world. Still less will the world, in these advancing days, sanction the abstracted system as regards the experimental sciences. Cambridge, having passed the rubicon which separated her from the outer mental current, must now float on.

We give her our God speed, and shall look with much anxiety for the fruits of her timely renovation.

MISCELLANEOUS CORRESPONDENCE.

METHOD OF SEPARATING MANGANESE FROM IRON, &c.

[To the Editor of the Chemical Times.]

Sir,—It is well known that one of the most difficult processes which the practical chemist has to contend with is the separation of oxide of manganese in the pure state from its native combinations. The most abundant ores of this metal, as black wad, pyrolusite, or grey manganese, are commonly met with associated principally with iron, carbonate of lime, and carbonate of barytes. Several rather circuitous methods are at present adopted to accomplish the separation of these different substances, in order to procure the manganese in a state appropriate for the preparation of pure manganese salts, as also for its appliances in the arts where its absolute purity is desirable.

The following method of separation appears to be one of the most exact and easy of execution of any that has been hitherto proposed. It must be premised, however, that I have had an opportunity to test its applicability only in the small way:—First, digest the substance, previously reduced to powder, in hydrochloric acid till effervescence has wholly ceased, and the odour of chlorine is no longer perceived; then evaporate the solution nearly to dryness; add chlorate of potash by small consecutive portions to the mixture ignited to redness in a crucible. By this treatment the chlorate of potash is made to furnish oxygen to the iron and manganese, which are converted to the state of insoluble oxides, while the lime and baryta persist as chlorides. This reaction permits the easy separation of the iron and manganese from the lime and baryta compounds, merely by dissolving out the chlorides, while the oxides subside as insoluble residue, which, after washing, are dissolved either in sulphuric or hydrochloric acid.

By the above process we obtain a solution of persalt of iron and protosalt of manganese, which may now be separated from each other by several methods, but I generally give the preference to the following one:—The solution of sulphate of chloride is, in the first place, evaporated, in order to expel the excess of acid and the salts redissolved in water. Chloride of soda, or bleaching liquor, is then added to the solution, which precipitates the whole of the manganese as a voluminous hydrated black peroxide, from which the water may be expelled by a temperature below redness, while the whole of the iron existing in solution already as persalt remains entirely unaffected by the chloride of soda, and may be separated by decantation.

Another method for the separation of iron from manganese, which, I believe, is the process generally had recourse to, is to evaporate the mixed chlorides to dryness, and heat the residue until the whole of the chloride of iron is converted to insoluble peroxide, after the separation of which the protochloride of manganese is redissolved and precipitated by the ordinary method with carbonate of soda.

I perceive in your last periodical you favoured my anonymous communication on the Separation of Lime from Manganese by inserting it in your journal. Should the above process meet with your approbation, you will oblige by its publication

A Correspondent.

MISCELLANEA.

ON THE ISOMORPHISM OF THE NITRITE OF LEAD WITH THE NITRATE.

By J. NICKLÈS.

The nitrite of lead is capable of crystallizing in every proportion with the nitrite; moreover, its crystalline form is identical with that of the latter; it is a regular octahedron. The identity of form and the property of crystallizing together constitute, therefore, a case of isomorphism. Hitherto the nitrite of lead has been considered to be anhydrous, whence certain authors have pointed out this case of isomorphism as being contrary to the law of M. Mitscherlich. They view the isomorphism of the nitrite of lead with the nitrate as an anomaly.

On analyzing some crystals of nitrite of lead, well dried between blotting-paper, they yielded 5.87 and 5.82 per cent. of water, which does not differ considerably from the theoretical number, 5.47. The atom of nitrate of lead, $NO^4 + O$, PbO, consequently becomes in the nitrite $NO^4 + H$, PbO.—*Comptes Rendus*, August 28, 1848.

On Sumbul Root.—The director of the Botanical Gardens at St. Petersburg, M. Fischer, says that the word Sumbul is applied in the East Indies to many aromatic plants. Thus the name of Sumbul Hindi is given to spikenard (Nardostachys Jatamansi); and the aromatic root of Valeriana celtica is called Sumbul Ekleti or Sumbul Ekelti, also Sumbul Kumi and Sumbul Italicus. The Sumbul-root, known since 1840 in Germany, was imported into Moscow and St. Petersburg by merchants from Khokand. About its origin nothing is as yet satisfactorily known; very likely it comes from some large umbelliferous plant, which appears to be similar to Archangelica officinalis. Thielmann and others have given an exact description of this root, and Reinsch has examined it chemically. Physiological and clinical experiments have shown that it is, in its effects, quite similar to angelica; it increases the energy of the digestive organs by a more active absorption and more ready assimilation of the chyle into blood. It restores the hæmatose functions, increases respiration and the development of animal heat, accelerates the circulation of the blood, the assimilation and the secretions.

On the Coating of Glass and Porcelain Vessels with Copper.—At the last exhibition of National Industry in Paris, glass and porcelain wares from Sèvres, such as crucibles, retorts, and evaporating-basins, covered with a galvano-plastic coating of copper, were exhibited. Similar vessels were exhibited at Berlin. The copper, according to Mr. Mallet, is applied in the following manner: the exterior surface of the vessel is smeared over with a thin coat of Canadian balsam, then strewed over with a fine powder of plumbago, and the latter connected with the copper pole of a galvano-plastic apparatus. Dr. Mohr recommends the vessel to be first coated very thinly with copal varnish, then to be strewed over with bronzing-powder, and this coating afterwards made perfectly smooth. The vessels are then filled with water, and placed in a solution of sulphate of copper, when the process of coppering is taking place.—*Buehner's Repertorium*, No. 145, p. 57.

Arsenite of Quinine.—At a recent meeting of the Society of Pharmacy of Paris, M. Soubeiran stated that arsenite of quinine is now much recommended as a remedy in cutaneous diseases. The process for preparing it, by double decomposition from sulphate of quinine and arsenite of potosh, was, he remarked, not a good one: the following process he had found to answer well:—℞ Sulphate of quinine, 100 parts; dissolve it in distilled water with the addition of a few drops of diluted sulphuric acid; precipitate the quinine with ammonia, wash it, press it, and dissolve it in

Rectified spirit, 600 parts
Add Arsenious acid, 14.4 "

heat them together, and filter. As the filtered liquor cools, the arsenite of quinine separates in acicular crystals.

Identity of the Picric, Chrysolepic, and Nitrophenissic Acids.—Prof. R. F. Marchand has confirmed, by further experiments, the identity of Dr. Schunck's chrysolepic acid with the picric or nitrophenissic acid. The form of the crystals of chrysolepic acid was found to be perfectly indentical with that of picric acid measured by Prof. Mitscherlich. The same conclusions have also been arrived at by M. E. Robiquet, by the analysis of the salts of lead.

TO CORRESPONDENTS.

"L. B."—Your suggestion shall be attended to.

"G. S.," who requires our opinion on some points connected with a probable advantageous modification of Smee's battery, shall be answered fully in our next. Meantime we will devote to the whole matter our anxious consideration.

Mr. Walker, of 44, Dean-street, Soho, thus addresses us:—"To the Editor of the *Chemical Times*.—Sir,—I should esteem it a favour if you oblige me with a little information on the following. I enclose a piece of paper which is coated with tin by means of a metallic solution brushed over the surface of the paper. It is made at a very cheap rate at Birmingham, and I want, if possible, to produce a similar article. Also, a cheap method of producing a crimson colour on paper similar to the piece enclosed." The paper is tinged scarlet, we imagine, by a lake. As to the other question we are unable to give an answer. Both metallic zinc and cyanide of potassium liberate tin from its proto-compounds; perhaps the process may be in this direction.

"Chemicus" thus addresses us:—"Sir,—Considering the rapid progress and numerous applications which organic chemistry (especially the vegetable department and compound radicals) is daily exhibiting, allow me to suggest that a series of lectures specially devoted to this branch of science, considered chiefly in relation to its fundamental principles, would confer inestimable benefit on the whole class of chemical students, as well as, it is to be hoped, materially advance the interests of the forthcoming *Chemical Times*. Such an exposition of the principles of oganico-chemical science published weekly (as being then presented in a convenient form to individuals who have not leisure to sit down to study the so-called Manuals of Brande, &c.) would tend materially to promote the cultivation of general chemistry, its application to the arts, and consequent appreciation where its absence is at present so generally lamented." We feel great pleasure in assuring our correspondent that a series of papers on this subject will speedily appear in the pages of the *Chemical Times*.

"W. G. S."—Your specimens are so withered and mutilated that we despair of being able to recognise them. We will endeavour, however, to do so, and communicate with you in our next. Meantime there can be little doubt that the remedies would be quite inefficacious in any confirmed case of stone or gravel.

"Agricola."—Aloes do not contain carbonic acid, except as a casual impurity (in carbonate of lime, &c.); even then the effect indicated could not be induced.

"Mr. Frederick W. Griffin," who sends us some valuable suggestions, is assured that we appreciate his kind offices, and will study to turn his remarks to the future advantage of ourselves and friends.

"Mr. Thomas Wilson."—Sulphuretted hydrogen gas is not a negative but a positive poison, a very small per centage being sufficient to kill, if its breathing be prolonged. The small quantities which escape in a chemical laboratory do not usually produce any vicious effect on the constitution. Dr. Christison, however, remarks that he has frequently suffered from headache due to this cause.

"W. G."—A very convenient kind of charcoal furnace, and much employed by chemists, is made out of a black-lead-pot. Full directions are given in Faraday's Manipulations for converting the pot into a furnace. The plan is as follows:—Cut a number of holes in the side of the pot by means of a knife and ratstail-file; then bind the pot with copper or iron wire, and drop in a grate about two thirds of the depth. On an emergency a wire grate may be constructed, but it soon burns away. A blacksmith can easily make a grate of wrought iron—cast iron is still better. Instead of a blacklead-pot a common brown ware flower-pot answers just as well, but is more difficult to cut. It generally cracks after having been used once or twice, but the wire binding prevents the pieces separating.

"Mr. H. Simpson."—The vulcanized indiarubber works are carried on at Goswell-mews, Goswell-road. The gutta percha works near the City-road-bridge.

"Mr. Robert Hunt" is thanked for his polite communication.

"A Subscriber, Dublin."—Your request shall be attentively considered.

"A Varnish-maker."—The formulæ for varnishes to which you refer were given on the authority of M. Dumas. It is unfortunate that copal and amber require to be melted at a very high temperature before they can be dissolved in certain menstrua. This melting or burning sadly deteriorates them. Would not a spirituous solution of bleached shellac answer your purpose?

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to annual subscribers sending a Post-office order directed to Robert Palmer, or an order on some party in town, for one guinea in advance, which will ensure the journal for twelve months. Half-yearly subscriptions, 13s.; quarterly, 6s. 6d. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—November 11, 1848.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By Dr. SCOFFERN.

[*Continued from page* 1.]

Having mentioned the chief indications which theory points out as requisite to the successful manufacture of sugar, it will now be necessary to explain some chemical relations of that substance, otherwise the description of injurious changes which occur during the various stages of manufacture will be confused. Under the general denomination sugar are comprehended several substances of organic origin which possess a sweet taste. Chemists are not exactly agreed on the question of what assemblage of qualities should constitute a sugar, but they are at least agreed thus far, that mere sweetness is not in itself sufficient. Thus the acetates of lead are sweet, and so are certain compounds of the metal glucinum; but to call either of those compounds *sugar* would be doing violence to ordinary ideas. As I need not enter minutely into this disquisition, I will content myself by saying that the sugars which are necessary for us to consider are the following:—Sugar of the cane, of the grape, and of manna: they possess the following composition:—

	Carb.	Hyd.	Oxy.	Water.
Cane-sugar	12	10	10	+ 1
Grape-sugar....	12	12	12	+ 2
Sugar of manna	15	16	16	

There is also a sugar of milk, of which the composition is C^{12} H^{12} O^{12}, but we may dismiss it altogether.

With regard to the three sugars of canes, of grapes, and of manna, it is necessary at once emphatically to remark that the three terms are expressive of composition, but not of origin. Thus the beetroot, the pineapple, the juice of the palm-tree, and of some other vegetables, contain a sugar which has the composition of C^{12} H^{10} O^{10} + 1 Aq., and having exactly the same properties, physical and chemical, as sugar obtained from the cane is denominated by chemists, for the sake of distinction, cane-sugar.

Again, with respect to sugar of grapes, otherwise called glucose, not only does it exist in grapes, but also in honey, and the greater number of sweet fruits which are produced in the temperate zone. Moreover, it exists in brewer's wort, being generated from the starch, or rather dextrin, of the malt, by the agency of fermentation. It may also be obtained as the result of a peculiar treatment of starch with oil of vitriol;* and also (which is of greatest importance, in a practical point of view) from cane-sugar. Indeed, the change of cane-sugar to grape-sugar, by the agency of heat, alkalis, and acids in general, imposes the greatest drawback to the maximum production of cane-sugar.

This change of cane-sugar to grape-sugar is by no means difficult of comprehension when we consider the slight atomic alteration necessary to accomplish the end. By referring to the composition of the two it will be seen that grape-sugar is merely cane-sugar plus the elements of three equivalents of water. Accordingly this removal of the necessary elements is unfortunately most easy, whereas no agency yet known can affect their recombination to form the original material.

The non-chemical reader must not associate the idea of moisture with the presence of water of composition in cane or grape sugar; nor imagine that cane-sugar made damp would become grape-sugar, or grape-sugar made partially dry would return to the condition of cane-sugar plus its one of combined water; or that any amount of drying would expel the one atom of water from cane-sugar, and leave the compound (C^{12} H^{10} O^{10}), *i.e.*, dehydrated sugar, behind.

The fact is that cane-sugar, in its purest, driest state, never has, probably *never can*, be obtained without one atom of water. It will, however, exchange its water for something else, for instance, lime or baryta, and form the combinations respectively of (C^{12} H^{10} O^{10}) + lime or baryta, as the case may be; and this is the kind of evidence which enables chemists to speak confidently of a real dehydrated sugar, although, indeed, it has never been obtained. Had it so happened that sugar would combine with no substance whatever, chemists would have been for ever ignorant of the fact that crystallized cane-sugar, as we obtain it, although the elements of eleven atoms of water are really present, *i.e.* (H^{11} O^{11}), contains one atom of each united to form one atom of water.

Similar remarks are applicable to grape-sugar. The practical reader need not, however, be detained by them: he will easily apply the train of reasoning from the one to the other.

Cane and grape sugar, in respect to their association with combined water, are by no means anomalous, chemistry presenting numerous parallel instances.

Thus the crystalline body commonly known as oxalic acid is really a compound of oxalic acid and water. If oil of vitriol, a body possessing a great tendency to unite with water, be added to oxalic acid, and the mixture heated, the water of combination separates, and *the elements* of oxalic acid *are isolated*;—not, however, the acid itself, because it is incapable of separate existence. If, however, lime or baryta, or strontia, oxide of silver, or oxide of lead, be offered to the acid in exchange for its water, then a combination of the two results, and water is evolved.* In this way we learn the composition of hypothetical oxalic acid, just as we do of hypothetical cane or grape sugar.

There are some cases in which a substance can be obtained, and, therefore, is not hypothetical, but which are so rarely seen that very false popular ideas of their nature prevail.

This is the case with sulphuric acid, a substance which in popular language, and, indeed, in loose chemical language, is considered as identical with oil of vitriol.

In strict truth, however, oil of vitriol is a compound of water and real sulphuric acid; the latter being separable—and, when obtained, presenting the appearance of driven snow.

We need not farther multiply instances of this kind.

It may, probably, seem extraordinary to a reader that I have associated cane and grape sugar with oxalic, sulphuric, and nitric acids; but sugar and glucose, when chemically considered, are acids, and as such ought to be studied.

The possession of a sour taste is not an infallible quality of acidity; a much more strongly marked peculiarity of acids is their power of combining with bases, a property which cane-sugar as well as glucose exercises in a remarkable degree.

The sugar of manna, otherwise called mannite, would merit no attention here were it not for the fact that, under certain peculiarities of temperature, and impurities hereafter to be detailed, both the juice of the cane and the beetroot, to say nothing of other juices containing cane-sugar, assume a peculiar fermentation, which leads to the formation of this saccharine result.

Although there exist various kinds of sugar which in precise language should each be designated by its prefix, yet, for the sake of brevity, the word sugar often occurs alone. Under these circumstances cane-sugar is always indicated, and the term, thus limited, will be employed throughout this and subsequent papers.

It is not difficult for one accustomed to mix with practical men engaged in pursuits bearing upon sugars to foresee many objections to this simple and rigid but truthful classification of sugars, on which all chemists are agreed. The commercial world has other classifications, other designations of sugar, such as low sugars, high sugars, muscovado and clayed sugars, weak sugars, strong sugars, and the like. This classification to be good should be true. If true, no one has yet been able to discover where its truth lies.

All sugar possessing the composition of C^{12} H^{10} O^{10} + 1 Aq possesses identity of specific gravity, identity of taste, of chemical reagencies; not the most practised sugar broker or manufacturer could discover any difference, whether prepared from cane-juice, beetroot-juice, or the juice of the palm-tree. Further proof of absolute identity cannot well be required.

Of course it need not be pointedly remarked that in such case the sugar to be subjected to examination is supposed to be absolutely pure. If otherwise, the kind of impurity might indicate its origin, inasmuch as the kind of impurities accompanying sugar varies for each individual plant. The variation here, however, is evidently not due to the sugar, but the presence of impurities.

This has been the grand point of divergence between the chemist and the sugar-manufacturer. The only true classification of sugars has been abandoned by the latter, and an artificial one created, which has been productive of nothing but dissatisfaction and loss.

Whenever chemists desire to study the characteristic properties of a new substance, they invariably commence by operating upon it in its purest and simplest condition. Following this rule (which is the only safe and salutary one), let us examine the mutations to which sugar is liable, when merely dissolved in water, before we attempt the investigation of the more complex case of its admixture with the organic constituents of the juices which naturally contain it.

If pure sugar be dissolved in water the solution is perfectly absorbed; were it not for certain refractive phenomena observed in connection with transmitted light, such a solution might be mistaken for pure water. These conditions will be sufficient for our *point du depart*, and serve as a standard of comparison for the mutations soon to be described. But others not immediately evident, but easily educed, exist. Thus, if a ray of polarized light be passed through such a solution the ray is deflected towards the left, and if a solution of either of the subacetates of lead be poured in there will be no precipitate.

If this solution of sugar be boiled without the admixture of any substance, a remarkable series of changes will occur. After the lapse of ten minutes, more or less, according to the degree of heat, the solution, originally colourless, will have become yellowish, and the tint will be seen gradually to increase. Indeed, by prolonged boiling, the organic sugar, as proved by an interesting experiment of M. Soubeiran, can be entirely destroyed. If a portion of the liquor, after having been subjected to boiling, be now treated with a solution of subacetate of lead, a yellowish precipitate deposits; if a ray of polarized light be made to traverse a portion of the same liquor, instead of being deflected to the left as before, it bends towards the right. In short, some considerable change in the constitution of the sugar has evidently taken place even after but a short period of boiling.

If a portion of pure solution of sugar be rapidly boiled down to its crystallizing point,

* Starch may be converted into glucose by mixing it with about four times its weight of water, and about 1-100th part of its weight of sulphuric acid, boiling the mixture for thirty-six hours, supplying water as fast as it evaporates; then saturating the acid with lime, separating the sulphate of lime, and concentrating the liquid by sufficient evaporation. This curious fact was accidentally discovered by Kirchoff, a Russian chemist, as he was employed in a set of experiments to convert starch into gum. He conceived that the starch could be rendered soluble in water by boiling it with very dilute sulphuric acid; and by prolonging the boiling he gradually observed the conversion of the starch into sugar. Vogel ascertained that during the conversion of starch to sugar no gas whatever is extricated. Mr. Moore and M. de Saussure ascertained that the quantity of sulphuric acid was not diminished by the process. Saussure ascertained that 100 parts of starch, when converted into sugar, become 110.14 parts. Hence he drew as a conclusion that starch sugar is merely a compound of starch and water in the solid state. Braconnot has shown that, by a similar process, sawdust, straw, linen rags, and even the bark of trees, may be converted into a sugar similar to that of grapes or starch.

* The water, in these cases, acts as base, and is evolved by exchanging places with another base. Hence it is termed *basic water*.

and poured into a copper sugar-loaf mould, the perforated apex of which is plugged, the mass will crystallize into a yellowish compound, from which compound, if the pan be removed, a syrup, more or less dark, will flow away.

Had the original sugar experienced no chemical change, the syrup of drainage should have been colourless—should have been only so much of a solution of pure sugar and water, ready to crystallize on further evaporation. If evaporated, however, and formed into a cone, only a portion crystallizes, and the second syrup of drainage is much darker than the first. The change, whatever it may be, has progressed,—a further portion of the sugar has been destroyed.

If the process of boiling be repeated with the admixture of any alkali or alkaline earth—lime, for example—all the changes just indicated will be greatly increased; and a similar remark applies to acids in general.

What are these changes? how developed? how prevented? These are the important questions that now present themselves for consideration.

The first change consists in the formation of glucose (sugar of grapes); the second consists in the rapid change of the latter into melasinic, sacchulmic, sacchumic, and some other imperfectly-examined bodies.

Practically these changes on the large scale cannot be altogether prevented, inasmuch as sugar solutions cannot be evaporated commercially without a certain amount of heat. The destruction may, however, be diminished at least nine tenths by the removal of all impurities from the juice to be evaporated by abolishing the use of lime, and diminishing the amount of heat.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXII.

(LECTURE LX.)

FATS AND FIXED OILS—*(continued)*.

CONSTITUTION OF THE FATTY SUBSTANCES.

The action of alkalis converts fats and oils into certain peculiar acids, and a substance which Scheele, its discoverer, termed the sweet principle of oils, but which is now usually called glycerine, or the oxide of glyceryle. This reaction may be accounted for upon two different assumptions: we may assume that fats and oils are ternary compounds, and that the powerful intervention of the alkalis determines a molecular movement between their constituent elements, resulting in the formation of fatty acids which then combine with the alkalis, and of glycerine; or we may assume that fats are natural saline compounds of glycerine with the fatty acids, and that the action of the alkalis upon the oil or fat causes simply a decomposition analogous to that which other salts suffer under similar circumstances, viz., the alkali, being a stronger base than glycerine, displaces the latter and combines with the liberated acid. This latter view would seem the more correct of the two, considering that the isolated glycerine possesses the faculty of entering into combination with acids.

STEARIC ACID.

This acid is produced by converting into soap, by means of an alkali, the animal and some of the vegetable fats. It crystallizes in white, brilliant needles, which may be readily reduced to powder. It has neither taste nor smell. It fuses at 167° Fahrenheit, and solidifies at 158° Fahrenheit. On distillation it yields, among other products, margaric acid. It is insoluble in water, but soluble in alcohol (more freely in boiling than in cold alcohol). It dissolves in an equal weight of ether.

MARGARIC ACID.

Margaric acid greatly resembles stearic acid; it differs, however, from the latter in fusibility, its fusing point being 140° Fahrenheit, whereas that of stearic acid is 167° Fahrenheit. Margaric acid is found more particularly among the products of the saponification of vegetable oils and of human fat.

Margaric acid is (anhydrous) composed of

$$C_{34}\ H_{33}\ O_3.$$

In the isolated acid we find this complex atom in combination with one equivalent of water, in the margarates with one equivalent of base.

Stearic acid contains only two and a half equivalents of oxygen to the same proportion of carbon and hydrogen as we find in margaric acid. Stearic acid may be represented as a compound of two equivalents of margaryle (the assumed compound radical of both margaric and stearic acids) with five equivalents of oxygen,

$$2C_{34}\ H_{33} + O_5.$$

In the isolated acid we find this complex atom in combination with two equivalents of water, in the neutral stearates with two equivalents of base.

Margaric acid, then, is more highly oxygenated than stearic acid, and accordingly we find that oxidizing agents, nitric acid, for instance, convert stearic into margaric acid.

OLEÏC ACID.

Oleïc acid is obtained principally from soaps prepared with the liquid part of oils and fats. It is a colourless liquid. It has a slightly rancid odour and taste. It is insoluble in water, but soluble in all proportions in alcohol of 93 cent., in oils, and essences.

The composition is represented by the formula

$$C_{44}\ H_{39}\ O_4.$$

GLYCERINE.

(*Oxide of Glycerile.*)

Glycerine is a colourless, inodorous, liquid, of syrupy consistence. It has a sweet taste. Its density is from 1.25 to 1.27. It is soluble in water and in alcohol in all proportions, but insoluble in ether. It is decomposed by heat; among the products of its decomposition we find acroleïne, a species of volatile oil, which emits a most insupportable smell.

A great many substances, more particularly the metallic oxides, and many salts, are readily soluble in glycerine. It combines with acids. Its combination with the margaric, oleïc, and stearic acids constitutes the neutral fats. It is found in the water remaining after the preparation of diachylon plaster: sulphuretted hydrogen is transmitted through this water to precipitate the oxide of lead, and the fluid filtered off from the precipitate is subsequently evaporated at a gentle heat.

The composition of frec glycerine is represented by the formula

$$C^6\ H^7\ O^5 + HO.$$

In combining with the acids, and more particularly with the margaric, stearic, and oleïc acids, it loses the equivalent of water.

EXTRACTION OF THE FATS AND FIXED OILS.

The process of extracting the fats and fixed oils resembles in its general features that by which the vegetable juices are obtained; certain modifications are, however, required according to the fluid or solid condition of the respective oils and fats.

I. EXTRACTION OF FLUID OILS.

The oleaginous seeds are ground to powder in a mill; the powder is put into square ticking bags, which are then subjected to the action of a strong press. Care must, however, be taken to apply the pressure gradually, in order to prevent the bursting of the bags.

Some substances require certain preliminary operations; thus, almonds are, in the first place, shaken about in a coarse bag, and subsequently sifted, in order to remove the yellow matter from their surface. The testaceous husk of the seeds of Ricinus communis is peeled off, in order to obtain the oil colourless; and so is that of the Indian pine, which, were it left, would be sure to remain impregnated with a certain quantity of oil, and accordingly to reduce the amount of the product by so much.

The grinding of the oleaginous seeds to powder is always preferable to their reduction to a paste, since, in the latter case, the parenchyma is so thoroughly comminuted that a much larger portion of it will find its way through the ticking than is possible with the powder; and this admixture of parenchyma must necessarily tend to impair the transparency of the oil, and to retard its depuration, which, of course, again will increase the chances of alteration. It might also happen that matters which in the seed are not mixed with the oil, but are soluble in it, would get into the product and modify its properties.

The process of grinding and pressing answers exceedingly well for the extraction of castor-oil, linseed-oil, spurge-oil, poppy-oil, croton-oil, nut-oil, &c. &c.

The application should always be avoided, if possible, since it disposes the products to become rancid; the process of blanching almonds by means of boiling water should, therefore, never be resorted to where the almonds are intended for the oil-press.

In the arts the aid of heat is usually resorted to to facilitate the extraction of linseed-oil and nut-oil. The application of a moderate degree of heat, steam heat for instance, does no great harm in this respect, though it tends to dispose the product to become rancid; in some cases, however, the heat is carried to incipient torrefaction, which necessarily tends to alter the product, imparting to it a degree of acridity that renders it unfit for medicinal purposes. Apothecaries should invariably prepare their own linseed-oil.

2. EXTRACTION OF SOLID OILS.

This requires, in the first place, the application of heat, in order to liquefy the solid oil, and to assimilate its condition thus to that of the naturally fluid oils.

The following is the usual process of extracting the solid oils:—

The substance containing the oil is pounded in a heated mortar, and, in most cases, afterwards triturated on a heated marble slab. This process serves to soften the fatty matters, and to produce a paste.

Cacas must, in the first place, be freed from its husk; for this purpose the cacas is torrefied, spread on a slab, rolled with a rolling-pin, and the detached husk is then removed by the winnowing-fan.

The paste must be promptly pressed between tinned iron plates heated in boiling water. Delay of this process tends to reduce the amount of the product. A good strong press is indispensable. The addition to the paste of one fifth of its own weight of boiling water facilitates the expression of the oil. Josse prepares his cacao butter in this way. Demachy, on the other hand, advises to expose the cacao to steam, as is done with linseed, and to press it subsequently between heated plates. This manipulation is less convenient than the preceding process; yet, for the preparation of laurel-oil, I have found it answer better than any other method.

Another way is to boil the paste with water; the fatty matter rises to the surface, and may be readily removed after refrigeration. This process, which was formerly usually resorted to to effect the extraction of laurel-oil, is still used in the arts for the extraction of palm-oil and of the wax from Myrica cerifera.

The oil expressed by any of the preceding processes, of course, requires depuration. The method usually resorted to for this purpose is to filter through paper in a double-bottomed funnel, heated by the steam of boiling water. Some practitioners prefer to keep the oil melted in the water-bath until the dregs have subsided.

If the operator has a stove at his disposition, and has to deal with readily-fusible fats, the filtration process may be conducted in the stove. Otherwise, the best way is to conduct the filtration in the water-bath of an alembic.

The process of extracting the animal fats is very simple. It suffices to expose the adipose tissues to a gentle heat, to effect the liquefaction and separation of the fat. The preparation of hogslard may serve as a general example:—

Take the flea of pigs, cut it into pieces, and knead them in cold water to separate the blood. Bruise in a small mortar, and melt the mass subsequently in a pan at a gentle heat. When the melted fat appears perfectly clear and transparent (which is a proof that it holds neither water nor solid fat in suspension), strain through a linen cloth of close texture; run the strained lard into pots, cover, and keep in a cool place.

The matter remaining on the strainer is put in a pan, melted over the fire, and finally subjected to strong pressure. By this means a second product is obtained, which, though of less whiteness than the first, is yet serviceable for many preparations.

Fats and fixed oils must be kept in a cool place. Contact with the air is more particularly to be guarded against.

Rancid oils are altogether unfit for medicinal purposes.

The best way for the apothecary is to prepare the oils as much as possible extemporaneously.

Solid fats keep very well in close stoppered or corked glass vials, filled to the brim, and placed in the cellar or some other cool spot.—(Henry and Guibourt).

FOREIGN SCIENTIFIC INTELLIGENCE.

ARTESIAN WELLS AT VENICE.

Venice has until within a short period been supplied with water, partly from 144 public and 1,990 private cisterns, in which the rain-water was collected, and partly from the Seriole, a canal of the Brenta, the supply by the latter occupying many barges daily. From the year 1825 to 1830 several attempts had been made, by command of the Austrian Government, to dig artesian wells; all, however, proved unsuccessful, on account of the quicksands met with at a certain depth. Every hope of success appeared to have vanished, until M. Degoussée, of Paris, made another attempt in August, 1846, in the square of Santa Maria Formosa. After having proceeded with the work for six months, by which time they had reached a depth of 61 metres, water gushed forth. In April, 1847, another attempt, in the square of St. Paolo, was also crowned with success; the well (spring) met with, at a depth of 60 metres, supplies 250 litres of water, carried up to a height of 4 metres above ground. At present six artesian wells are completed, and three more are being worked at. The water contains hydrocarbonic gas and carbonic acid, and, on these two ingredients being disengaged by exposure to the air, it is perfectly fit for drink, and may be used for all domestic purposes.—(*Compt. Rend.*, t. xxvi., p. 50).—*Poggendorf's Annalen der Physik und Chemie*, vol. lxxiv., sect. 3.

RESEARCHES ON THE PRINCIPAL METALLIC POISONS, BY M. ABREA, OF BRAZIL.

All experimentalists, when called upon to apply practically the existing methods of toxicological research, have had to regret the want of a method positive and unique as their guide. Indeed, the different treatises on toxicology, which otherwise give so much and such valuable information on the inquiry into poisonous substances, leave the reader in the greatest embarrassment, by proposing for every kind of poison different modes of procedure, which are by no means all of the same practical use, and even the best of which vary greatly for different poisons. The inconvenience arising from this is very great.

The operator, who proposes to himself to find out with certainty the presence of a poison in a suspected matter, is obliged to make a great many experiments, and to analyze separately a great many parts of the *matter*, in order that he may arrive at suppositions, in case the problem does not consist in the research after the poison supposed to exist.

M. Abrea has endeavoured to remedy this defect as regards the principal metallic poisons, and to reduce the medico-chemical operations in this point to a simple problem of analytical chemistry,—to determine the nature of one or more metals occurring in the interior of an organic body.

In order to arrive at a solution of this important problem, M. Abrea has successively reviewed the various methods till now practised for the special inquiry into each different metal.

Struck by the neatness of the results arrived at in searching after antimony by the method of M. Millon, which consists in the destruction of the organic matter by the combined action of hydrochlorie acid and chlorate of potassa, M. Abrea conceived the idea of basing upon it the foundation of a general method, and of modifying this proceeding in such a manner as to enable him to extend it to an analysis of all the principal metallic poisons.

The method is adapted to all the compounds of the following metals—arsenic, mercury, tin, copper, zinc, antimony, lead, and silver.

The mode of operation is as follows:—Analysis of solid substances found in the stomach; of masses ejected by vomiting and motions; of the tissue of the gastro-intestinal canal; of the liver and the other organs, or, finally, of all other suspected solid matters; of the blood, urine, and other organic liquids, previously concentrated at a moderate temperature.

The operator should begin with examining attentively with his naked eye, or rather aided by a magnifying-glass, the substances ejected by the stomach and the bowels, the substances found in the digestive canal, and on the mucous surface of the same canal. He will thus, under certain circumstances, find the indications which will put him in the way of pursuing his inquiry; he will even be able to discover in the digestive canal, and particularly in the folds of the mucous membrane, some particles of the poisonous substance. In this case he should carefully pick up with a small forceps the particles of poison, and endeavour to ascertain their nature by the ordinary means; but, supposing that no important indication had resulted from this physical inquiry, he should proceed to the examination of the poisons comprised in our table as follows:—

By means of a fine pair of forceps he should divide the suspected matter to be analyzed into very small portions; take of them a certain weight, never above 200 grammes, and place them into a balloon of two litres,* together with half of their weight of pure and fuming hydrochloric acid. To the neck of this balloon a stopper is adjusted, perforated by two holes, one of which is destined to receive a tube fifty-five to sixty-six centimetres long and one centimetre wide in its interior diameter, and reaching several millimetres into the hydrochloric acid. From the other aperture a tube curved at a right angle proceeds, the vertical branch of which plunges through a stopper into the distilled water contained in an eprouvette. The mouth of the latter has another hole, to receive a straight tube, which must not plunge into the water.

Having disposed of the apparatus in this manner, the balloon should be placed in a sand-bath, and the eprouvette in cold water, to be changed from time to time; the sand is maintained at a temperature approaching to a boiling point of the liquid, without, however, actually reaching it. This is done by agitating the balloon from time to time for at least four hours.

The fragments of the organic matter gradually dissolve in the hydrochlorie acid, and ultimately constitute with it a dense homogeneous liquid of a more or less deep colour. The sand-bath is then withdrawn, and the balloon exposed to an open fire so as to make the liquid boil for two or three minutes. This having been done, the operator commences gradually to introduce through the large tube crystals of chlorate of potassa (care being taken to agitate the balloon continually,) till sixteen or eighteen grammes of it have been introduced for every hundred grammes of the suspected matter. A most lively reaction will take place, and an abundant disengagement of chlorine gas; the liquid becomes clearer and clearer, and, finally, perfectly limpid and of a yellow colour, the intensity of which appears to depend principally on the great superabundance (excess) of chlorine that remains in the solution. And not only the liquid of the balloon, but also the water of the eprouvette, offer in the highest degree the characteristic odour of chlorine. On the liquid of the balloon are seen floating little fragments of carbon and a resinoid, which is little met with in an analysis of the blood, but principally abounds when the inquiry concerns tissues of the liver and other parenchymatous organs.

The apparatus is now allowed to cool, the liquid of the balloon is filtered, and mixed with the water of the eprouvette, and also with that which has been used at repeated times to wash the remnants of the filter.

A current of well-washed sulphuretted hydrogen is then for a considerable time passed through the whole liquid, and it is afterwards set aside in a well-corked bottle until the following morning. There will in all cases be a precipitate formed more or less abundant, in which should be sought for all the metals comprised in the table, with the exception of silver and zinc. This precipitate will, however, contain sulphur and a little organic matter, both of which must be disposed of in the following manner:—

The precipitate is thrown into a filter without folds, is washed with distilled water, and put into a small balloon with its own weight of pure and fuming hydrochloric acid; it is then made to boil, and some spangles of chlorate of potassa added. When the reaction has ceased a little distilled water is to be added, and heat is to be applied with precaution, in order to drive off all free chlorine that could possibly be there. By another filtration in Berzelius paper there will be obtained a liquid very limpid, and hardly coloured a little yellow. It is in this liquid where the arsenic, the antimony, the mercury, the copper, the lead, and the tin must be sought for, provided the suspected matter contained any of them. With respect to the zinc, as it is not precipitated in the contents of an acid liquor by hydrochloric acid, it must be sought for in the liquid obtained by the filtration after the action of the hydrosulphuric acid. The silver, which cannot be found but in an insoluble state, must be searched for in the residues of the first filtration.

Now comes the examination of the most sensible means to discover the presence of the several metals comprised in the table, care being taken to avoid any errors that may present themselves in making experiments. In the liquid obtained at the last-mentioned place are to be looked for simultaneously the arsenic and antimony by the aid of the apparatus of Marsh, as modified by the Academy of Sciences. The mercury, the copper, the lead, and the tin are then to be sought for in the liquid of the apparatus, after a solution had been made by aqua regia of all the deposit at the bottom of the bottle. Concerning the zinc and silver, the first must be searched for in the liquid obtained by filtration after the action of the hydrosulphuric acid, and the other in the remnants of the first filtration.—*Journ. de Pharm. et de Chimie*, 3e serie, tome xiv., Oct., 1848.

* A litre is about a quart English.

PARIS ACADEMY OF SCIENCES.

ON THE COMBINATION OF SULPHURIC ACID WITH WATER. BY M. BINEAU, PROFESSOR AT THE FACULTY OF SCIENCES, LYONS.

Several chemists have occupied themselves with determining the specific gravities of sulphuric acid at different degrees of dilution. But the comparison of the results furnished shows a considerable discordance.

Thus, for instance, the acid whose gravity is

1.725 at 15° C. (60° F.) contains 84.22 per cent. of concentrated acid according to Vauquelin, and but 81 per cent. according to Parkes. Again, acid of 1.618 gravity contains, according to Vauquelin and D'Arcot, 74.32 of concentrated acid, and, according to the results given by Parkes and Ure, only 71.59. The chemical and commercial importance of sulphuric acid has induced M. Bineau to make some new experiments with a view of ascertaining the specific gravities of this acid at different degrees of solution.

The following table is the result of M. Bineau's investigations :—

Real Acid. per cent.	Specific gravity.	Real Acid. per cent.	Specific gravity.
0.	1.000	73.3	1.6675
3.86	1.028	74.	1.676
5.	1.035	74.2	1.6775
7.1	1.051	74.7	1.685
10.	1.073	75.	1.688
11.7	1.086	75.5	1.6935
15.	1.112	76.	1.700
17.5	1.131	77.	1.712
20.	1.151	78.	1.724
21.4	1.162	78.4	1.729
25.	1.192	79.	1.736
30.	1.232	80. ...	1.748
32.2	1.250	80.2	1.750
35.	1.274	81.	1.759
40.	1.317	82.	1.770
42.2	1.336	83.	1.781
45.	1.362	84.	1.791
48.9	1.399	84.1	1.792
50.	1.410	85.	1.800
55.	1.460	85.2	1.808
56.4	1.475	86.6	1.813
60.	1.514	87.	1.816
63.4	1.553	88.	1.823
65.	1.570	88.8	1.828
66.	1.581	89.	1.830
67.	1.593	90.	1.836
67.6	1.600	91.	1.841
68.	1.605	92.	1.845
68.2	1.608	93.	1.848
69.	1.617	93.5	1.8495
70.	1.628	94.	1.850
70.3	1.632	94.5	1.851
71.	1.640	95.	1.852
71.3	1.643	96.	1.853
71.7	1.648	97.	1.8545
72.	1.652	98.	1.8555
72.9	1.663	98.5	1.8560
73. ...	1.664	99.	1.8564
73.1	1.666	100.	1.857

REVIEWS.

The Sugar-Planter's Manual. By Dr. Evans.
The Practical Sugar-Planter. By Leonard Wray.

[*Continued from page* 10.]

We left Dr. Evans's book in our last number at page 146, wherein it is stated, on the authority of Soubeiran, that the process of vacuum-pan boiling did not accomplish any destruction on sugar. We affirmed M. Soubeiran to have been in the wrong, and we are assured that a longer acquaintance with the operations of a sugar-refinery would have confirmed M. Soubeiran that his judgment of the vacuum-pan had been too favourable. That its use has conferred a great boon on the manufacturer of sugar cannot be doubted, in materially diminishing the loss occasioned by open-pan boiling; but the fact cannot be too generally proclaimed that sugar in solution cannot be exposed to a heat of even 100°F. *for a moment* without the supervension of a certain, though for that short period, perhaps, not discoverable, amount of destruction. Hence may be deduced an indication, *the golden indication*, of sugar manufacture. *To diminish, as far as practicable, the degree of heat and the time of heating.*

The fearful waste occasioned in the colonies by the usual mode of boiling the juice of the sugar-cane in open pans hung over one long flue, and exposed to violent flame, produced from cane trash, *i.e.*, canes from which the juice has been expressed, has induced some proprietors to abolish open fires altogether, and to substitute in their place tubes through which there is a circulation of high-pressure steam. Dr. Evans repudiates this plan, and reasonably enough :—

"Should the proprietor of a sugar estate," he remarks, "be desirous of using high-pressure steam in his boiling-house, it must be better worth his while to do so at once judiciously and effectively, by combining it with the advantages derived from a diminished atmospheric pressure, although at a somewhat greater cost.

"I cannot, therefore, recommend this description of teache; for the advantages which it offers over the chaudière à bascule, or even over a well-constructed copper vessel placed upon its own furnace, are not on the whole balanced by its greater cost in the first instance, the increased expense attendant upon its application subsequently, and by the additional trouble and labour incurred by its introduction into a boiling-house for the accomplishment of so partial an object."

The description of the vacuum-pan is perfectly intelligible, we should imagine, to any capacity. The author first explains the philosophy of the subject, then the practice :—

"By the above methods the concentration of the syrup is effected by an active ebullition under the entire pressure of the atmosphere, consequently at a temperature so high that the operation must be carried on with great rapidity, otherwise the sugar would receive great injury, although that produced by charring or burning would be obviated.

"To prevent the occurrence of the evils arising from a high temperature, Mr. Howard, in the year 1819, took out a patent for concentrating saccharine liquids in vacuo.

"It is well known that liquids boil at a temperature inversely proportionate to the pressure exerted on their surfaces. If we take a Florence flask containing a little water, and hold it over the flame of a spirit-lamp until the water boils and the steam escapes freely, then suddenly remove the lamp and cork the flask carefully, it will be perceived that the water will cease to boil, but that, on plunging the flask suddenly into cold water, ebullition will recommence, and that it will again cease on holding the flask over the lamp. In this experiment the air is driven out of the flask by the steam, which forms an atmosphere of its own in the upper part of it. When the flask is corked and plunged into the water the steam is condensed, a vacuum is formed, and the water begins again to boil, because the pressure has been removed from its surface.

"Mr. Howard took advantage of this fact, and reduced the experiment to practical utility. For the purpose he had in view he invented an apparatus consisting of a globular copper vessel, enclosed within an iron or copper jacket, and between the two steam was introduced to heat the syrup contained within the former, which was the boiler or concentrator. To this was affixed a tube for the escape of the vapour as it arose, which was condensed by a jet of water introduced for the purpose. An air-pump was likewise attached to form the vacuum in the first instance, and afterwards to get rid of the condensed vapour.

"Many improvements have been added to the original design of Howard, but the principle has always been retained. The essential ameliorations, however, may be confined to two—the heating of the syrup by a long coil of steam piping introduced into the interior of the pan, and the condensation of the vapour, and its ultimate escape by means of an extensive metallic worm, kept cool by the continued pouring of an artificial rain.

"I cannot enter into a description of all the modifications that this method of concentrating has been made to undergo. That information can be much better supplied by any of the large coppersmiths who are in the habit of manufacturing the various kinds of apparatus applied to the manufacture of sugar.

"Every vacuum-pan should be furnished with a thermometer to point out the temperature to which the syrup contained within it is exposed, and a barometer to measure the amount of exhaustion produced in the vessel. It is customary to consider this exhaustion as a force, and to describe its degree by the number of inches that the mercury in the tube rises to, less than would be produced by the pressure of the atmosphere at the time. For instance, if the pressure of the atmosphere be equal to thirty inches, while that within the partially exhausted concentrator be equal to three inches only, it is usually said that an amount of vacuum or exhaustion has been obtained equal to twenty-seven inches of mercury, that being the difference of pressure exerted in the respective cases.

"There is no mode of concentrating syrups at present known which offers advantages equal to those of the vacuum-pan, when well constructed and in good working order. For to a very large heating surface resulting from the steam-jacket and the extent of steam-pipe, inserted in the interior of the vessel in the manner of a closely-packed spiral, is added the greatly increased evaporating power caused by the diminished pressure on the surface of the liquid.

"It has been proved that for every $\frac{1}{10}$ of an inch that the barometer rises or falls there is a corresponding rise or fall of the boiling-point of water equal to $\frac{176}{1000}$ of a degree, and consequently that, where that fall is equal to twenty-seven inches, the boiling-point of water, instead of being at 212°, must be at 164°.5. Under such circumstances a rapid concentration of cane-syrup can be effected at a temperature ranging between that point and 180° Fahr., and, as the experiments of M. Soubeiran have shown, without the accompaniment of any change in the chemical composition of the sugar."

The fallacy of Soubeiran's conclusion we have already sufficiently alluded to :—

"Unfortunately," remarks the author, "its (the vacuum-pan's) general adoption, that is, its introduction on every estate, will for ever be impossible, in consequence of the great outlay required for the purchase of the apparatus, the skill required for its management, its liability to get out of order, and the necessity of more efficient workmen for its repairs than are as yet to be found in the colonies. The first of these objections is not so applicable to large estates as it is to small ones, as they offer a larger scope for getting the return of an adequate interest on the money so invested; and in such a case the others would be overcome by the necessity which would arise of obtaining that knowledge from abroad which is not to be had at home, were there an urgent demand for its supply.

"There can be no doubt that on those estates which, from their extent and the fortunate position of their owners, will admit of the sinking a capital sufficient to obtain the vacuum apparatus, in conjunction with steam defecating and evaporating vessels, and a powerful and well-constructed mill, the ameliorations which would result, both in the quantity and the quality of the products, obtained under a prudent and intelligent management, would fully compensate the expense incurred; but how few are the estates which at the present time are in such fortunate circumstances!"

Another unfortunate limit to the general use of the vacuum-pan in the colonies is the scarcity of water. But the vacuum-pan even where employed in the colonies has not yet had fair trial; its true genius has been very ill understood; the object of vacuum-pan boiling having been that of obtaining the maximum weight of dry extract capable of being turned into the sugar hogshead without sufficient regard to purity or grain. In general, too, the liquors subjected to the process of vacuum-pan boiling have been so insufficiently purified that the full powers of the instrument could not have been exerted. In Demerara, where vacuum pans are now not uncommon, their first introduction did not give

satisfaction, owing to the incompetence of those who worked them. In some cases the sugar, instead of being let off at the proper density, was boiled so hard or stiff that the process of digging it out by spades through the man-hole was obliged to be had to recourse to ; and even now the usual plan of adapting the Demerara vacuum-pan sugar for the market is wasteful in the extreme. The boiled crystalline mass, in consequence of the original impurity of the juice, being mixed with a very dark-coloured syrup, or molasses, the latter is washed away by deluging it with water from the rose of a watering-pot. The result of this process need not be told—a portion of the dark-coloured syrup is, of course, washed away, and with it a still larger portion of the sugar. In the sugar-refining operation, where white sugar is the staple desired, the process of working, liquoring, or elairceage, as it is ealled by the French, is indispensable : the washing liquid is a saturated solution of pure sugar and water. Being saturated, of course, it eannot dissolve any more sugar, and its agency is, therefore, merely limited to mechanically displacing the dark-coloured syrup. This plan should be followed in the eolonies whenever the process of washing is thought desirable; but nothing less than sugar absolutely white should be the result of sueh an expensive operation. If a bright yellow sugar be the staple desired, a far better plan of operation consists in operating on a juice so purified, so far from dark-coloured syrup that the process of clairceage is altogether unnecessary.

Every step of the colonial sugar manufacture is attended with unnecessary destruction : even the process of crystallization, the theory of which is so perfectly understood by all rational manufacturers of erystalline substances, is wantonly violated in the West Indian colonies, the fatal belief having been aequired by the West Indian manufacturers that their true interest eonsisted in packing into hogsheads the maximum of sweet matter, without reference to crystalline state or the chances of waste by leakage during a long voyage.

If we premise that "*a teache*" is the last of any series of open boiling-pans, and, eonsequently, the one in which the syrup has attained its maximum of eondensation, and, therefore, in which there is greatest fear of destruction by burning, we will now introduce the reader to the refined and skilful colonial process of effecting crystallization :—

"In the manufacture of sugar as at present pursued in the colonies, the syrup, after its due eoncentration in the teaehe, is passed directly into the coolers. This operation is denominated 'skipping' or 'striking,' and is effeeted either by ladling, or by means of a copper skipper, a vessel so adapted in shape as to fit the interior of the teache, and to admit, at once, the contents of that vessel through a valve made for that purpose. The skipper, when charged, is rapidly raised by a crane, and it is supposed that the great injury which the sugar is apt to undergo at this particular time, owing to the intense heat operating upon a highly inspissated syrup, is thus, in a great measure, prevented.

"The coolers usually employed are shallow wooden troughs, varying in size from five to ten feet in length, and from three to five feet in width, but in depth thcy never exceed one foot or sixteen inches. In some of the islands these vessels are made of copper, but with what object I am ignorant.

"Two skips at least, and usually several, are shot into each cooler, where they are allowed to remain until granulation has commenced, and until the saccharine mass has acquired sufficient solidity to permit of its transportation to the hogshead without risk of its leaking entirely into the molasses eistern.

"During its sojourn in the cooler, the hot and inspissated syrup is occasionally stirred about for the purpose of mixing together the different skips, and to obtain throughout them a uniform temperature ; in other words, to reduce them to the temperature of the surrounding atmosphere, with as little delay as possible. If such have been the motives which have caused the planter hitherto to treat his concentrated syrups in this manner, assuredly he could have devised no plan better suited to obtain his ends, for the position of the coolers in the boiling-house exposes their contents to the strong gusts of wind which are admitted on all sides into the building, and the shallowness of these vessels causes the heated syrup which they contain to present a very large surface to the cooling influence of the atmosphere.

"By pursuing this plan the inspissated syrup is most effectually and rapidly cooled ; and, as at the state of concentration to which it has been previously brought it contains a quantity of sugar more than sufficient for its saturation, the latter is deposited in an amorphous or semi-erystalline state, and diffused through the chilled and viscid molasses.

"The half-crystallized sugar and the mother liquor or molasses being thus blended together form a doughy and homogeneous mass, which is cured with difficulty, and presenting in the sugar obtained an imperfect crystallization, which is denominated by reiners false grain. Moreover, that portion of the molasses whieh escapes carries with it a large quantity of sugar, while that which remains adheres to each small particle of sugar with great tenacity, and is there retained by a kind of capillary attraction.

"We see, therefore, that by pursuing the system now in use the cooling of the syrup is promoted, but its crystallization and perfect euring are prevented.

"When the mass of sugar and molasses has become sufficiently cooled, it is dug out of the eooler, shovelled into a bucket or some other vessel, carried into the euring-house, and then thrown into the hogsheads as if it were so much manure, where it remains until the drainage of the molasses is sufficiently complete to admit of its shipment. To assist the cooling process the euring-house is generally opened to windward, and it is not unfrequently kept as cool as possible.

"Had the planter intended to eonvert the cane-juice into dough or bird-lime, he could scarcely have invented a more suceessful method of accomplishing his purpose, but to obtain sugar a more ill-judged method, or one more defective in principle, eould not be employed."

But what judgment shall we pass on the consistency and common sense of those colonial proprietors who, whilst they unceasingly complain of Government injustice and announce their own ruin, actually employ sugar, the object of all their eare and anxiety, for the purposes of fuel? The sugar-cane contains about 90 per cent. of juice and only 10 per cent. of woody fibre. Of this juiee scarcely 50 per cent. is extracted ; and for the reason that, if extracted, the cane refuse *would not burn sufficiently well to accomplish the purposes of evaporating the expressed juice !*—

"That, by any mechanical means, the whole of the juice will ever be extraeted from the cane cannot be expeeted ; indeed, from obvious physieal causes, this result would be impossible ; but it is certain that the quantity at present obtained, 50 lbs., may very readily be increased to 70 or 75 lbs. from 100 lbs. of canes.

"It is evident that, in recommending the effective squeezing of the eanes, the preservation of the megass has been regarded as a very secondary consideration.

"No doubt it would be exceedingly agreeable were we able to extract the entire amount of juice from the canes, and yet find in the remaining ten per cent. of woody fibre, &c., a sufficiency of fuel to evaporate an equal amount of eane-juice during the ensuing erop. Unfortunately, we cannot have our cake and eat it too. The question to be decided is very simple, namely, whether all our labours have been expended in raising canes for fuel, or for the manufacture of sugar.

"The absolute quantity of wood contained in the stem of a sugar-canc is ten per cent. of its weight. The only other constituent which, when the cane is carefully exsiccated, may likewise serve as fuel is the sugar, and this may be considered as amounting to seventeen parts per cent. The quantity of water will then be about seventy-two parts in one hundred. These proportions are subject to variations from many causes ; but they are sufficiently stable to illustrate what I wish to point out, namely, that the amount of combustible substances contained in the cane is to the water as twenty-seven to seventy-two.

"The extent of evaporation that ean be effected by the combustion of sugar has not, I believe, been ascertained in this part of the world ; it is only in the eolonies that the extensive use of this substance, as an article of fuel, is ever heard of. Let us, however, suppose that the mixture of sugar and wood, such as exists in a earefully dried cane, equals, in this respect, coal, and that, when it is employed in the unskilful and wasteful manner at present practised with the megass, it is capable of evaporating five times its weight of water. It will follow that the fuel obtained from 100 lbs. of dried cane is equal to effect the evaporation of 135 lbs. of water, or, in other words, that it will be able to inspissate the whole of the cane-juice contained in 200 lbs. of eanes to the state of a strongly granulated syrup.

"Fifty pounds of megass (if carefully dried and preserved with the greatest care) obtained by the expression of an equal weight of juice from 100 lbs. of canes would, by a similar calculation, contain ten pounds of wood and $\frac{4}{9}$ of 17 lbs. of sugar = to about $17\frac{1}{2}$ lbs. of fuel, capable of evaporating $87\frac{1}{2}$ lbs. of water, or of reducing to perfeet dryness the whole of the juice contained in 121 lbs. of canes.

"Unfortunately it is found in practice impossible to dry the megass in such a manner as to preserve within it the quantity of combustible materials given above. For whether it be stacked at once, or be previously exposed for some hours to the rays of the sun, fermentation of the juice retained in it commences, and the sugar is converted into incombustible bodies, as gum, lactic acid, &c., or into others, which are rapidly evolved, as carbonic acid and alcohol ; so that, when the time arrives when its use as fuel is required, little more remains available for the purpose than the woody fibre, that is to say, that instead of obtaining $17\frac{1}{2}$ of fuel from canes which have given 50 parts in 100 of juice, ten parts only are actually serviceable ; and the amount of evaporation which could be effected by this quantity would be equal to fifty pounds of water only.

"The planter would appear to be in a great measure aware of this fact, by offering, as a reason for the imperfect pressure to which he submits the canes, the fear of having a larger evaporation to effect than his fuel is capable of accomplishing. When he states, however, that by imperfect pressure he is thereby obtaining a proportionately-increased supply of fuel for the following year, he is manifestly in error, for the only constituent of the cane on which he can rely for that purpose is the woody fibre, which will be equally abundant to whatever extent the pressure may have been carried.

"To exemplify the loss which a sugar plantation annually sustains from an adherence to this most shamefully extravagant system, I will suppose that by increased pressure the amount of cane-juice obtained is augmented merely from 50 lbs. to 60 lbs. in every 100 lbs. of canes. It is clear that the amount of sugar, molasses, and rum, must be increased in the same proportion, and, therefore, an estate, which otherwise would give 200 tons as its annual product of sugar, would, from this cause alone, afford 240 tons.

"Let us also suppose that, there being no other available fuel at hand in place of the megass, coals have to be imported from England at an expense of £1 per ton, and that 240 tons would be required to evaporate the requisite quantity of canc-juice to make the same number of tons of sugar ; the price of the coals would

represent the expense attending the augmentation of the produce. The sugar would be worth at least £20 per ton, consequently the clear gain would be £800 less £240, or £560.

"The profit, however, would not be confined to the mere increase of forty tons of sugar; the megass, after due fermentation, would produce an amount of farmyard manure which, when thrown upon the land, would augment the quantity of canes for the ensuing crop, at least, twenty per cent., and, in the greater number of colonies, very much more. In Barbadoes, for instance, there are many estates that, after a good supply of manure, readily yield, in favourable seasons, three tons of sugar per acre, which, without that assistance, would not yield one.

"But, admitting that a planter may not choose to employ his megass in that manner, it is still available for the purpose of fuel, for its woody tissues remain in all their integrity; and probably, by its employment, the quantity of coals required would be reduced to less than half the quantity given above."

Our space now admonishes us that we must turn from our pleasing duty of discussing more fully the merits of Dr. Evans's book, for the purpose of examining the sugar treatise of Mr. Wray.

The latter approaches his literary duties with a kind of information different from that of Dr. Evans. The doctor, although not a stranger to the colonies and the colonial sugar manufacture, expatiates but little on the subjects of tropical agriculture or engineering. As a chemist well conversant with the chemical department of his subject his chief remarks are applied in that direction. Mr. Wray, on the contrary, has devoted the greater part of his book to the consideration of agricultural and engineering subjects connected with the sugar-cane—subjects on which his long residence in various colonies enables him to speak with some authority:—

"Sixteen years' experience as a practical planter in Jamaica, Bengal, and the Straits settlements, gives me, I think," remarks the author, "the necessary qualifications; and should gain for me that attention which, I hope, the succeeding pages will, on perusal, be found to merit."

Had the author omitted to devote any portion of his pages to chemical criticism of subjects which he does not understand he would have done well. In these matters his practical experience with tropical agriculture, and long residence in the colonies, avail him nothing—although his chemical criticisms appear with an air of authority that might characterize the experience of a Berzelius or a Liebig.

The following extract from our author on the subject of gluten does certainly no credit to his chemical acumen:—

"Gluten is a substance that presents itself under varied forms, according to the manner in which it is acted on by the different matters with which it comes in contact. This circumstance has furnished a befitting opportunity for chemists to enrich their nomenclature with many singular new names: thus we have gluten, zimome, gliadine, legumine, vegetable albumen, fibrine, caseine, diastase, *cum multus aliis!*

"Now, the planter will not be displeased to learn that, notwithstanding this formidable array of names, they all resolve themselves into one substance—gluten; but, as the term vegetable albumen is very commonly used, I shall employ that designation, as well as gluten, whenever I find occasion to do so, it being understood that they are one and the same substance. In cane-juice gluten exists in solution until the acid which holds it dissolved is evaporated by means of heat, or by saturating it with an alkaline solution, which causes the gluten to become insoluble or coagulated, so that its particles, meeting together, adhere to each other, and rise to the surface in the form of thick scum, which is often called vegetable albumen. All cane-juice contains a proportion of the free acids, at times so great that, on leaving the mill, it produces a slightly acid reaction on litmus-paper; whereas, generally, they are not to be detected by that test, being combined with gluten, &c., so as to present no symptoms of their existence. But on the application of an alkali (temper lime) a union immediately takes place between the alkali and the acid, and the gluten forthwith assumes the form of coagula, and becomes insoluble in water. A further application of alkali would have the effect of redissolving the coagulated gluten, and holding it in a state of solution, until an acid reagent could be used to saturate the alkali, which would cause the gluten once more to assume the form of coagula. Thus we see that a very great deal of nicety is required in what is termed tempering cane-juice or cane-liquor; and we perceive at once one great reason why it is that an alkaline menstruum (temper) in excess is so injurious: viz., as being not only sufficient to saturate the acid which holds the gluten dissolved, but effecting the re-solution of the coagula about to form."

Again, at page 339, the disquisition on gluten is resumed:—

"A menstruum composed of creosote, very much diluted with water, has the effect of coagulating gluten (in its various forms) to a remarkable degree; the knowledge of which fact leads me to imagine that it may possibly be useful in defecating cane-juice. But the most delicate test that we have of the presence of albumen (*ergo* gluten) in any liquid is corrosive sublimate (bichloride of mercury), which is so extremely effectual that, if a single drop of the saturated solution of corrosive sublimate be let fall into a liquid containing only the two-thousandth part of albumen, it will immediately occasion a milkiness, and produce a white, curdy precipitate. Corrosive sublimate is, however, one of the most virulent poisons that we know of, and the bare mention of its use in clarification may occasion great dread; but I am by no means certain that it may not be used by a careful operator with success.

"Speaking of its employment for the removal of whatever vegetable albumen (gluten) remains in cane-liquor after clarification in the first clarifier, I will suppose that a very dilute solution of corrosive sublimate be gradually added to such liquor, until the curdy coagula present themselves; and then an alkaline solution (lime-water), to saturate the acid set free.

"In this case the vegetable albumen instantly combines with the calomel in the corrosive sublimate, forming a white flocculent precipitate; whilst a portion of hydrochloric acid is set free, which is immediately rendered neutral by the lime, with which it combines. Orfila has proved, by experiment, that the precipitate in cases of this kind is a compound of calomel and albumen, which is entirely inert. I do not, of course, imagine that such an agent as this can be employed in boiling-houses: but the facts stated are very interesting to the inquiring and intelligent planter."

Creosote and corrosive sublimate to be used in the preparation of sugar! Good Hippocrates, defend us from *such* a chemist. In another place Mr. Wray parades as a new fact the precipitation of chlorine by means of nitrate of silver, and proposes the latter agent to be used with the object of separating common salt from such sugar as may contain it, altogether forgetting the obvious facts that nitrate of potash would be formed, and that the excess of nitrate of silver necessarily used, not being separable by any practical means, would totally ruin the product.

Let Mr. Wray accept as an axiom the following,—that no substance should be used for the purpose of *purifying cane-juice that cannot be again separated from it easily and totally.* This accomplished, Mr. Wray would be at liberty to purify the juice by arsenic even (if arsenic had that power), or by corrosive sublimate, as he suggests; but, short of this achievement, let Mr. Wray moderate his chemical daring, or he will benefit the physician and the undertaker much more than the manufacturer of sugar.

We have been hitherto constrained to express a strong adverse opinion on our author's chemical criticisms—with what justice the reader will judge for himself from a perusal of the selected passages, and they are by no means the most unfavourable of those to be found in the treatise. A few sentences, however, there are which manifest a considerable amount of acumen. A gentleman who could so well appreciate the laws of crystallization as to indite the following ought to have written more reasonably on other branches of chemistry:—

"In no case can crystallization proceed under such favourable circumstances as when the syrup is thin and limpid; so that the crystals, in forming, may have freedom of motion. On the contrary, a thick and tenacious syrup opposes insurmountable obstacles to a perfect crystallization; and consequently the crystals are small, irregular, weak, and clammy; thus being difficult of drainage. Many boilers think that because they can evaporate almost the whole of the water contained in their syrups by the low-temperature principle, without fear of burning, &c., that it is incumbent on them to concentrate very high; seemingly unconscious or unheedful that they are running counter to the first principles of crystallization. I must, therefore, once more repeat, that if the planter wishes to secure a good description of sugar, which will drain readily and thoroughly, he must boil low."

And the following extract, with which we shall conclude, strikes at the root of all that long series of impropriety of sugar manipulation which has mainly contributed to the ruin of the West Indian colonies:—

"*I would wish to impress on the planter in the strongest possible manner that the operations in the boiling-house should tend to the accomplishment of two great objects; viz., the complete separation of all extraneous matter from the cane-juice, so as to bring it, as nearly as possible, to the state of sugar and water alone; and secondly, the evaporation of the surplus water, so as to leave the sugar in the condition of a fine white syrup, which will crystallize wholly and well.*"

The author's sense of the importance of this injunction is sufficiently indicated by the italics in which it appears. On this chemical point we at least do not differ with him. This short sentence embodies the golden rule of sugar manufacture.

In conclusion we would say, after a careful perusal of the two volumes before us, they are deserving of attentive perusal by all whose interests are mixed up with the sugar culture. Dr. Evans's production, moreover, is worthy a place in every scientific library.

An Introduction to Botany. By JOHN LINDLEY, Ph.D., F.R.S. Fourth Edition, with Additions and numerous Corrections. Two volumes. Longmans.

A definition in science, like a preface, the last concern of the author, is also the first to meet the eye of a reader. At first sight it might appear that a limitation of the ends of inquiry should precede and guide inquiry itself; it does so, but only when the state of knowledge has advanced to a certain stage of development. Knowledge, like property, cannot be distributed until it has been created, and to provide for its classification while as yet it remains only a possibility is, perhaps, an amusing, certainly a profitless, occupation.

Botany professing to treat of plants, the question soon presents itself, what organizations are to be included in this designation? Where is a line to be drawn between the plant and the animal? The old distinction consisted in the supposed impossibility of locomotion, and in the local nutrition of plants. But it is now well ascertained that the power of locomotion is not peculiar to the animal kingdom,—the brittle-worts (Diatomaceæ) or young algæ, for example; while a fixed point of attachment to the earth is in some admitted plants neither essential to production nor nourishment. The case of

aquatic Thallogens may be adduced in confirmation of this remark. Linnæus made the distinction to hinge on consciousness, which he assumed to be wanting in the plant (*Vegetabilia crescunt et vivunt. Animalia crescunt, vivunt et sentiunt*). But how can this assumption, necessarily arbitrary as it is, be admitted as the basis of a scientific division?

According to Linnæus, the sensitive plant, or the Dionæa, would have less claim to this noble attribute than the polypus. De Candollc distinguishes plants from animals by the means of voluntary motion, and the stomach, with both of which animals are provided. But as some plants manifest as distinct evidences of perception as many animals, moving, catching small insects, selecting their own food, the denial of consciousness to them is gratuitous, while, far from the stomach being absent in the plant, every cell for the purposes of life and health may be regarded as a stomach. Jussieu's definition is almost too trivial to be quoted, "Living beings which grow and reproduce themselves, but which neither move spontaneously nor feel, are called plants."

Dr. Lindley's definition of a plant has the merit of brevity and simplicity, "A cellular body possessing vitality, living by absorption through its outer surface, and secreting starch." This last power, unknown in the animal kingdom, is possessed by all vegetables; and M. Payen has shown that those equivocal bodies, the calciferous corallines, are truly plants. He took a piece of coralline officinalis; treated it with dilute muriatic acid, to get rid of the incrustations; washed it; then treated it with ammonia; again washed it; and placed it, with a little tincture of iodine, between two plates of glass under the microscope. All the quaternary substances contained in the cells, or which had penetrated their sides, immediately became tinged orange yellow. After this preparation he introduced between the glass plates a drop of sulphuric acid (1 equiv. acid, 4 equivs. water), and he was then able to follow the process of disaggregation which marked the arrival and passage of the acid; an orange tint, brown next the tissue, which contained quaternary substance in abundance, was first visible; then in the rest of the tissue were seen the first directing reactions finishing the effect of the tincture of iodine; the cellulose became gradually divided into groups of amylaceous particles, which gave a beautiful violet-coloured outline to the cylindrical cells radiating or spread out symmetrically from the point of insertion of each joint.

The *elementary organs* (vegetable tissue) of all plants have for their organic basis a ternary compound, called *cellulose*, itself derived from *cambium*, or organic mucus, a viscid, azotized secretion: it is the *organizable* matter of vegetable physiologists. This latter is of universal occurrence between the cells of all vegetable fibrines, and it is probable that it constitutes the whole exterior covering of all plants. It is described by Payen as containing substances analogous to those which constitute animal bodies, that is to say, including nitrogen. It is also mixed with other materials not azotized, such as dextrine, gum, starch, sugar, glucose, mannite, &c. From this organic mucus, *membrane*, as true cellulose, may be regarded as being in the beginning a gelatinous precipitate. It is, therefore, like all such precipitates, a collection of globular molecules adhering by their points of contact; hence its permeability.

Membrane varies in transparency, being in some cases so thin as to be scarcely observable, except by the little particles which stick to it, and in others (ferns, fuci cryptogami, &c.) coloured from its origin. Always thin at first, it thickens by the incorporation of secreted matter. The first layer of matter is invariably azotized, and is now appropriately called *protoplasm*; it tears readily, as if its component atoms did not cohere with greater force in one direction than another. It is in all cases, when first formed, destitute of visible pores; but, as it is permeable to fluids, it must be furnished with invisible pores.

Elementary fibre may be compared to hair of inconsiderable fineness, but its variation in size is remarkable. In *crinum amabile* Dr. Lindley found it $\frac{1}{7250}$ of an inch in diameter. It is generally transparent and colourless, but frequently of a greenish colour. In its most simple state it forms a loose spire, coiled up in the interior of cells. Griesbach took these loose fibres for animalcules, and called them *phytozoa*. He describes in a lively manner their behaviour when in water, their oscillations, and movements of their tails, never once doubting that there were so many manifestations of consciousness.

From these three, organic mucus, membrane, and elementary fibre, all the elementary organs of plants are constructed. They are, 1. Cellular tissue; 2. Pitted tissue; 3. Woody tissue; 4. Vascular tissue; 5. Lactiferous tissue. All these forms are modifications of one common type, the simple cell, however different they may be in native formation or appearance. They are all developed in bodies that originally consisted of nothing but cellular tissue. The embryo is only an aggregation of cells. When its vital principle has been excited, and growth has commenced, woody tissues and vessels are generated in abundance. Schleiden is of opinion that the cells of plants, including the so-called vessels, but excluding lactiferous tissue, allow of two periods being distinguished in the life. In the first, that of their origin and isolated development, the membrane forming them grows in its entire substance by true intersusception. But as soon as the cells have adhered to form the cellular tissue, and constitute the mass of a certain plant, or its parts, this mode of growth ceases entirely, or falls so far into the background that its continuance is a matter of doubt.

The morphology of tissues is one of the best cultivated departments of inquiry at the present day. Dr. Lindley's account of the researches of Mohl, Schleiden, and others, is necessarily succinct, but for an introductory work sufficiently ample. No outline of ours could do justice to a work which is itself condensed to a remarkable degree; the reader will consult his interest by making a more direct acquaintance with our author.

The seventh section, on amylaceous matter contained in tissue, presents the results of the latest researches on starch, the true nature of which is a modern discovery. An analysis of the section may not be unsuitable.

The grains of starch are perfectly white, semi-transparent, generally irregularly oblong, sometimes compound, and marked with oblique concentric circles; they are extremely variable in size, some being as fine as the smallest molecular matter in pollen, that is, not more than $\frac{1}{25000}$ of an inch in diameter, others being as much as $\frac{1}{750}$. Mohl has shown that they often form the centre of grains of chlorophylle. In the milky juice of euphorbia they look like short cylinders enlarged at each end with a round head; double-headed granules of this kind are not, as yet, found elsewhere. Starch grains when suspended in water have a distinct motion of rotation, and this motion looks as if spontaneous, for several floating near each other in the same medium impart perceptible active motion, while others remain inert.

Turpin called such granules *globuline*, and considered them the most elementary form of vegetable tissue. Some of these starch-like granules appear to have, under particular circumstances, the power of spontaneous growth, by which they multiply and increase themselves externally. This is particularly visible in the fecula of barley, which, if observed in its original state, is found to be composed of angular irregular bodies, some of which are in a state of great minuteness, and seem to have a power of spontaneous motion in water. Shortly after germination, these bodies, according to Turpin, appear to lose their substance, to become more transparent and flaccid, a circumstance which, he thinks, is owing to a chemical change of their starch into sugar; the bodies, however, at this time retain their property of becoming blue under the action of iodine. When this alteration has been carried far enough the maltster stops the new chemical action by heat, and fixes the sugar, producing malt.

When the amylaceous granules are placed in water of a certain temperature, rendered sweet by the dissolution of their own sugar, and exposed to the influence of the oxygen of the atmosphere, they produce little sprouts like themselves from their sides. Turpin states that, if examined after fermentation has been going on for some hours, they will be found to have formed several new granules, exactly like the mother granules; and he not only considers this to be the cause of the curious phenomena observable in germination, but regards the granules as seeds, and the result of their growth as a plant which he calls *Torula cerevisiæ*. He adds that in the inside of each of the new granules during fermentation he finds a number of small granules. Dr. Lindley has not repeated the observations of Turpin further than to ascertain that the granules in fermentation do sprout, and that they have at that time lost all their starch, for iodine produces insensible effect on their colour.

Schleiden ("Grundzüge," second edition, 1845) thus gives the explanation of the nature of starch after the discoveries of Fritsche, Payen, Mohl, and himself:—

"Starch when dry is tolerably hard, and falls to powder when rubbed between the fingers; when moist it is rather gelatinous; when dried from solution it at first forms a trembling jelly, and afterwards becomes vitreous, brittle, and as clear as water (even in lichens); when perfectly clean and fresh from the plant starch gradually dissolves in water; in the plant it is usually protected from solution by an incrusting wax, albumen, mucus, or any such substance, outside. Starch is easily (partially) soluble in boiling water, acids, or alkalis; insoluble in alcohol, ether, volatile or fat oils; it is stained blue by iodine, even in dilute solutions (and the iodide of starch is not more soluble in water than ordinary starch, but it is insoluble in acids). It appears to be changed through intermediate matter, as, for instance, lichen starch, into amyloid; through the material described by Henry in mace; into membrane, vegetable jelly, and, perhaps, also into gum. The chemical composition of starch is now placed beyond all doubt by Berzelius and Liebig, and stands thus:—

C.	H.	O.
12	20	10

"*A. Nature of Potato Starch.*—Potato starch, as usually purchased, forms rather a coarse, shining, white powder, mixed with larger particles. It is easily rubbed fine between the fingers, and it feels hard and gritty to the teeth. When moistened it forms bulky masses, and remains so without falling to pieces when dry. But if starch is well washed at long intervals with cold water, alcohol, and ether it becomes an extremely fine, glittering powder, which will not hold together if first moistened and then dried. Some time is required to get the starch perfectly clean, and the cleansing material for a long time shows signs of the presence of an albuminous and fatty matter. This accounts for the conflicting opinions that have for a long time existed as to the composition of starch; observers did not operate on clean starch, but upon various sorts of impure materials. Payen and Perloz first thought of thoroughly cleansing starch before use, and the result of their experiments was, that starch is a perfectly uniform vegetable product.

"Under microscopes magnifying 100 times the single particles of starch may be seen as small, fixed, egg-shaped granules; exceptions to this form are proportionally very rare. On the pointed end of the most perfect and distinct of these granules fresh from the potato a small black spot (Fritsche's kernel) may be seen. Very rarely, and only with a much higher magnifying power, can this spot be viewed in the potato, filled with a substance so thin that it is with difficulty seen to be a hole in the solid mass.

Around this so-called kernel a number of lines are drawn, sometimes white, at other times black; sometimes close together, at other times far apart; which are at first circular, but become more and more elliptical as they enclose the kernel in their foci. The substance seen between these lines appears sometimes clear, at other times dark. Single spots are often observed remarkably transparent, and a practised microscopical observer immediately recognises layers of various thicknesses, the outer ones being thicker than the inner, which in fresh starch appear quite gelatinous. The dark lines never cut the line of the outer envelope, and, however close they are placed to each other at the narrow end, each line always runs round into itself. If a starch grain with distinct black lines is placed under the microscope it will be seen that the lines, in whatever way they are viewed, have always the same direction. It, therefore, follows that these are not superficial markings, but are real layers, forming egg-shaped shells packed one above the other, and constituting the entire starch grain.

"It sometimes happens that, if a potato full of starch is sliced with a sharp knife so that the grains of starch are cut through, the inner sections are full of water and more gelatinous than the outer, which are drier and more compact. Perfectly dry grains show a smaller number of lines, which, however, are often more distinct, and a broad black line resembling a layer of air is observable. If the starch is allowed to remain long in a solution of gum the lines become less and less distinct. If it is dried with the gum until it forms a tough mass that can be cut through with a knife a greater number of sections can be obtained. In these a tolerably homogeneous substance can be seen which has rather an irregular hole in the centre, arising from the contraction of the moist inner layer.

"If starch is heated with sulphuric acid, under a microscope various appearances are observed sooner or later, according as the acid is stronger or weaker. After being for a short time in contact with the strong acid, that part of the grain which is touched with the acid swells into a cloudy mass and gradually dissolves. Grains of starch may often be seen, one of whose ends is dissolved, while the other is well defined, and even shows a nucleus of layers. In this way the whole mass of grains may be uniformly acted upon, and so that no rupture of the outer layer nor any discharge of the fluid contents is produced. After a longer action of the acid two different forms of solution are observable in equal abundance, which, probably, depend on the acid becoming weaker. In weaker acids the grains of starch gradually become transparent and gelatinous, and swell in such a way that they at first appear depressed on one side, and at last, after becoming cup-shaped, will be entirely dissolved at the edges. In the other form of slow action, which is probably occasioned by the concentrated acid, the so-called kernel at first becomes a visible and recognisable air-vesicle; this expands and causes one or two ragged slits in the inside of the grain, which gradually swells, becomes gelatinous, the lines disappear as far as the reaction extends, and at last the whole grain becomes invisible and dissolves. The next operation of the sulphuric acid is to draw water between the inner layers. If some potato starch is first heated on a small plate, so that a small part immediately on the plate is turned yellow, many remarkable transitions may be observed to take place gradually, and they give under the microscope the best evidence of the structure of the grains of starch. The first thing that happens, of course, is a drying, by which the so-called kernel is transformed into an air-bubble; this always characterizes the application of a dry heat, and may always be seen in the *farhina* of mandioca, in sago, &c. By degrees, as the separation takes place in consequence of drying, the separating lines become sharper, blacker, broader, and layers of air of various breadths become clearly perceptible: the layers are firmly attached at some points, less firmly at others, and thus they readily form spaces full of air. By degrees the layers are freed from one another like hollow cups, whilst an evident change into gum goes on at certain points.

"If the action of water gradually boiled is watched, an alteration which is at first very like that of sulphuric acid, as last described, is apparent. But in the last stages the action is so different that the cleft in the interior becomes a large hole, and the grain then looks like a very thick-skinned bag. By degrees the cleft becomes less distinct, but it is evident that the pasty masses thus produced always are traceable into a grain; and if a thin starch paste is mixed with water, and viewed under a microscope with a little iodine, the single swollen grains will be visible, whilst the additional water is not stained blue. I tried for a whole day to separate the boiled grains without success, but I think I may venture to conclude from my experiments that starch can absorb a large (but limited) quantity of water, and can, consequently, swell to a great size, but that it never actually diminishes in cold or hot water.

"Lastly, I may mention the behaviour of starch with cold water. If some starch is rubbed down with twice its volume of water for half an hour, a viscid, ropy, stiff paste will be obtained. Under a microscope a large part of the grains appears variously crushed, torn, divided, and partly pounded into small flocks; the inner (watery) layers are especially pressed out, as it seems, through the action of the rubbing, and their combination with more water presenting a flaky or granulated entangled mass, which may be stained blue by iodine, while the surrounding water remains colourless. All these experiments were made with commercial potato starch, and always gave the same results.

"In every experiment iodine was employed, and I never observed the remotest indication of any part in the grains of starch which refused to be coloured with iodine. From these observations it must be evident that without the combined use of the microscope and chemical reagents an exact knowledge of starch cannot be hoped for. In a growing potato the starch becomes dissolved, so that after three months scarcely a grain of starch can be found. The grain of starch preserves its solidity to the last moment, being gradually acted on from without inwards, and in such a way that, the ends of its principal axis making most resistance, the grain by degrees assumes the appearance of an uneven rod.

"*B. The Occurrence of Starch in Plants, and its various Forms.*—The useful treatise of Fritsche, and a few unimportant additions of Meyen, constitute all that has yet been published on the various forms of starch in plants. The forms of starch are exceedingly various, and are often so characteristic that, as Fritsche has observed, their orders and genera may be easily determined by them. The following are all that are at present known:—

"I. *Amorphous Starch.*—'Hitherto,' says Schleiden, 'I have found amorphous starch (a paste) only in the cells of two phanerogamous plants, namely, in the seeds of cardomum-minus, and in the bark of Jamaica sarsaparilla. It is probable that in the last plant heating in the fire has thus strangely changed the starch, of which there is generally an abundance, in sarsaparilla. For the most part this paste is found in the anomalous red roots, more seldom in the yellow ones, which are not as yet distinguished in the trade as substitutes for Jamaica sarsaparilla.'

"II. *Simple Grains.*—In most plants the grains are solitary clusters of two or three appearing among the others as rare exceptions. They may be further divided into

"§ I.—*Roundish Grains.*

"A. Central hole (Fritsche's kern) altogether wanting.

"1. Very small roundish grains occur nearly everywhere in the vegetable kingdom, occasionally contained in cells; for example, in carrots, in cambium in the winter, in leaves as centres of chlorophylle.

"2. Larger, irregular, knobby, often stunted, polygonal grains, in the bulbous buds of saxifraga granulata, in the corms of ranunculus licana.

"B. Central hole small, roundish.

a. with distinct layers.

"3. Grains coarse, rough, and often stunted, in the pith of cycads. Some masses resemble the grains that are met with in the scale-shaped subterranean leaves of lattereæa squamaria. The inner layers form egg-shaped granules, as in potato starch: the small exterior ones are comparatively irregular, being so excessively thick here and there that the whole grain is bluntly three-cornered.

"4. Grains egg-shaped. In the potato.

"5. Grains mussel-shaped. In the bulbs of the larger lilyworts, as in fritylaria lilium.

"6. Almost three-cornered in tulips.

"*b.* With indistinct layers, or none.

"7. Grains blunt polygons in zea mays. In albumen.

"8. Grains very small sharp-cornered polygons in oryza sativa. In albumen.

"C. Central hole long.

"9. Grains circular or oval and in a dry state, usually showing a star-shaped slit. In leguminous plants; for example, pisum, phareolus. In seeds.

"D. Grains apparently cup-shaped, with a visible hole.

"10. Well marked in the rhizomes of iris florentina and allied species.

"§ II.—*Flat Lenticular Grains.*

"11. Layers evident or not, with a hole which may be in or out of the centre, small, and round or lengthened, or star-shaped and torn open. As in triticum, hordeum, secale. In albumen.

"§ III.—*Flat Plates.*

"12. Layers visible, but it is at present doubtful whether they are really included one within the other, or are placed upon one another like watch-glasses. The first appears probable, both from analogy and from the phenomena observed in heating, and from dissolving in sulphuric acid. Found exclusively in ginger-worts in the rhizomes; not in marants.

"§ IV.—*Club-shaped Granules.*

"13. With long central holes in the milky sap of European and some tropical sponge-worts.

"§ V.—*Perfectly Irregular Grains.*

"14. In the milky juice of most tropical sponge-worts.

"III. *Compound Grains.*—Single grains are only found as exceptions in the group.

"§ I.—*Single United Grains without an Apparent Central Hole.*

"15. Two, three, or four simple grains are united in the rhizome of maranta (best Indian arrowroot), in the tubercles of aponogetan, in the thickened disjointed parts of the leaves of marattia, and in the root of bryonia.

"16. From 2—6 grains usually united regularly, seldom irregularly, in the bark of the roots of all sorts of sarsaparilla.

"§ II.—*Single United Grains with an Apparent Central Hole.*

"A. All parts of the grain of nearly the same size.

"17. From 2—4 simple grains united, the central hole being small and round. As in the tubercles of manihot.

"18. From 2—4 simple grains united, the central hole being large, and mostly torn in a stellate manner. As in the corm of colchicum autumnale.

"19. From 2—4 simple grains united, each grain being hollow and apparently cup-shaped. This remarkable form occurs in the grass-oil plant.

"20. From 2—12 grains firmly united in very irregular masses. In the rhizome of arum maculatum.

"21. A great number (often as many as thirty) small round grains joined, so as to form loose spherical masses, frequent in the stem of bernardia dichotoma.

"B. Small grains united round a much larger one.

"22. In sagus rumphii, &c., in pith, mostly in sago.

"Starch is the most common of vegetable productions. No plant can be named that does not, in some season or other, at least in the time when vegetation is at rest, secrete starch in more or less abundance, often, indeed, only in single grains, but often also swelling the cells from the larger quantity of it. The grains of starch adhere to the cell walls for the most part, accidentally, by means of mucus. The supposed hilum by which the grains of starch have been said to be held to the sides of the cell is one of Turpin's innumerable careless representations, and is entirely without foundation. The largest starch grain does not appear to be more than 0.05 of a line in the largest part. Starch can generally be separated from the cellular tissue by bruising and washing with water; often, however, it cannot, as, for example, when it occurs united to mucus, as in hedychium. It is not too much to say that, for two thirds of mankind, starch is the most important, if not exclusive, source of nourishment. It is certain that starch occurs in all plants, but not in such a state as to suffice and become fit for food. It often cannot be separated from other disagreeable substances, as in the horse-chesnut. Certain parts of plants secrete it more than others, viz., the albumen of the seeds (grasses), the cotyledons of the embryo (legumes), pith (palms), bulbs (lilywort), tubers, rhizomes, and roots of several different orders. In less abundance it is found throughout the winter in the bark and sap of trees; hence the possibility of making bread from the bark of trees in polar countries."

Of the work itself it is time to speak more specifically. Few will be inclined to deny to Professor Lindley the credit of having produced a learned and philosophical treatise. It is apparent that every source of information has been visited, and opinions from all quarters gathered. We have only to regret that, after so much study, the writer has not trusted more implicitly to his own descriptive abilities. Had the substance of the very extensive quotations in the first book been presented in the author's own language much valuable space might have been spared for fuller illustrations elsewhere. At present the work, if too large for one volume, is certainly not sufficiently extensive for two. Judging from often-recurring ambiguities of expression, and other indications of haste, we can hardly think that Dr. Lindley has done justice to his great abilities. Having said this, we may without further qualification recommend the work to our readers as a book to be coveted by all whose pursuits or inclinations are directed towards the acquirement of botanical knowledge.

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 18, 1848.

THE CHOLERA—ITS CAUSES AND ITS CONSEQUENCES.

ALTHOUGH pathology has failed to throw any light on the treatment of malignant cholera, and although chemistry is proved totally inadequate to the task of investigating the nature of that subtle emanation, if emanation it be, on which the fearful malady depends—although rational medicine owns itself powerless to avert the attack, and bold empiricisms of all kinds have equally failed—yet experience, even in reference to a subject so occult, has at length produced its fruits—in the shape of evidence consistent and valuable.

Amongst the host of conflicting discrepancies with which the study of Asiatic cholera is environed—amongst the variety of changing phases which soil, race, or climate has made it to assume—one prominent circumstance has been noticed and recognised by all observers: it is this,—that the poor, the destitute, the shattered in mind and body, are its first, and in many places its only, victims. In London hitherto the disease has scarce transgressed the bounds which all who are conversant with the metropolis know to be identified with the greater portion of its poverty, squalor, and wretchedness. In Edinburgh it has for the most part been confined to those precincts wherein poverty, roused from its lairs by new railroads and rising mansions, has been centralized and condensed. Thus far our position is substantiated by reference to the two largest cities in Britain; and, if we were to extend our examination, to include every part of Europe and Asia in which the cholera has yet appeared, we believe our conclusions would not have to be modified in the least degree.

Cholera, then, if our previous remarks be true, is, for all practical purposes of comparison, a class disease, a malady of the poor, the miserable, the forlorn—a disease which flies before the ministrations of easy comfort, and avoids the luxurious habitations of the rich—a disease which, if all men were sufficiently alive to the claims of their fellows, would probably not exist.

If it be necessary to contemplate this malady and its consequences from any other point of view than the one already chosen, in order the better to demonstrate the responsibility which attaches to all those who, by intelligence or worldly means, have the power in their own hands of ministering to the wants of their poor neighbours,—of almost guaranteeing an immunity from the fearful scourge,—we will imagine the exact converse of the existing case. We will imagine a disease as localized to the precincts of the opulent and luxurious, as the cholera has been to those of the poor and underfed—we will imagine that instead of Wapping and Lambeth and Horselydown—instead of Milbank Penitentiary and the convict-hulks—it was hovering with pestilential breath over the fashionable regions of Berkeley, Grosvenor, and Belgrave squares—that it was decimating the aristocracy—that it had entered Buckingham Palace, and already began to affect with alarm the mind of our most gracious Queen. To extend the analogy, we will imagine that a reasonable modicum of the poor man's wealth—the labour of his hands, his only riches—if tendered as an offering to the scourge to stay its partial ravages, would be of avail, and we will ask whether the offering would not be cheerfully made?

With a full confidence that none will judge so ill of Britain's poor as to imagine they would not submit to the sacrifice for such an end, we appeal to those whose means enable them to spare some superfluity from their substance to lend a helping hand towards the amelioration of the poverty, the squalor, and wretchedness to which thousands of the poorer inhabitants of the metropolis are subjected, and with which, in remote or immediate connection, the accession of cholera may be generally traced. Hitherto our remarks on this subject have been general and diffuse. We have now a practical suggestion to make, and it is this. Let there be immediately established, under some proper head, a committee of philanthropy, with a full and complete organization of surveyors, physicians, and chemists. Let frequent visitations be made to the dense regions of the metropolitan poor—let all obvious sources of impurity that are easily removable be removed—let food be given to those who hunger; physic to those who are sick; comfort, kindness, and Christian ministration to all—let no violence be done to wounded spirits by unnecessary publicity or inquisitorial bearing—nor let the ministration become a means of self-gratulation or pharisaical pride.

It is easy to disparage all systematic philanthropy—it is easy to lay an unction to the callous heart by repeating the worn-out observations of misfortune being retributive, and poverty too often but the reaction of vice—it is easy to eulogize the perfection of pauper unions and the benevolence of mendicity societies. The true hypocrisy of such remarks is perceived by none more fully than by those who make them—they are too often the polished exterior of a lie, the sheep's clothing that envelops the wolf.

We trust it may not appear irreverent in us to suggest that the leaders of such local philanthropic committees should be the more influential clergy. Their profession has for one of its objects the amelioration of human suffering and want. In no way, we should imagine, could they better or more delightfully fulfil this end than by swelling the stream of human kindness, which still, in spite of the hard but short-sighted utilitarianism of the age, meanders here and there unobtrusively through the world.

We are amongst those who entertain a notion pleasing in itself, and salutary in its operations, that no evil is unconnected with its antagonistic amount of good. How long the link of connection may be—whether extending beyond our ken or not—no matter. That it exists we do not doubt. If unseen, we believe it on faith; if seen, we are not the more assured.

Amongst the probable consequences of a sojourn of cholera amongst us we may enumerate these: A recognition of the necessity of studying the principles of public health, and of applying the deductions to the practical amelioration of the destinies of the working classes; a fuller exchange of sympathies between the rich and the poor, teaching the benefits as well as the pleasure of a reciprocity of kindly offices; and a more perfect appreciation of the inadequacy of medical treatment merely as such, without the collateral aid of dietetics, serenity of mind, and that peculiar combination of domestic circumstances which the English word *comfort*, and none other, is adequate to express. Whilst we are now writing the Bishop of London has addressed a circular letter to the clergy of his diocese, inculcating, fully and energetically, the spirit of our suggestions just made. Too much praise cannot be awarded to the right reverend prelate for the sound general advice which his document contains, more particularly that portion of it which principally inculcates the dictum of many years' experience—that the disease is

not contagious. It is to be trusted that his lordship's circular letter will have no little effect in moderating the fears of timid neighbours, and of ensuring kindness in their anguish for a number of unfortunates who else, on the first accession of the malady, might have been left to die in unmitigated agonies, unblessed by the solace of a friend.

THE CITY GAS MONOPOLY.

When the proposal was first made of illuminating large towns by coal-gas, the idea was pronounced absurd;—and this not only by those who long had been accustomed to a beaten routine, but by scientific men of high attainments and higher fame. Even the great Wollaston shook his head at it, and Davy very contemptuously asked whether it were intended to employ St. Paul's as a gasometer. So the scheme was damned authoritatively, and poor Winsor was proclaimed a mad enthusiast. Since then gas has been triumphant all over civilized Europe; for, whether we roam in Spain or Italy southward, or extend our inquiries to Sweden, Norway, and Russia on the north, gas has in every chief town displaced the dusky and offensive glass oil-cans, improperly called street-lamps. Even in Siberia we are informed that the lambent flame is seen; so that it would be difficult now to find even a native of that frozen land to commit a similar mistake as with him of yore who, fondly hoping to imbibe the sweet delicacies of train-oil from a street-lamp in one of our seaport towns, discovered, on putting his mouth to the burner, merely a blast of scented air; and such air, too, as would have sent a chameleon hungry away.

Thanks to the march of intellect, the theory and practice of coal-gas are now pretty well understood—knowledge cannot be monopolized for ever, although gas companies and other close corporations may monopolize it for a time. The London Common Council has been for some time pondering over certain facts which in themselves contain food for much thought, and which, when well discussed and understood, will break up a most oppressive monopoly.

It is a singular fact that Manchester can be supplied with coal-gas at the rate of 4s. per 1,000 cubic feet, whilst the city of London is charged 6s., and was until very lately charged 8s. Still more singular is it that the Manchester Gas Company, after paying all expenses, is enabled to net some £14,000 per annum, which sum is devoted to purposes of general improvement. It is somewhat singular, too, that the illumination of the city of London is monopolized by two companies, whose immoderate perquisites are not permitted to be disturbed by the commissioners of sewers,—why or wherefore does not appear; but an explanation can be assumed that is quite adequate to explain the circumstance, although not very creditable to either party.

In explanation of the difference of price per 1,000 feet of gas in Manchester and London, it might at first seem reasonable to urge the higher price of coal in London than in the provincial city. Were we justified in admitting the remark to be valid—and to assess the *pro tanto* amount of the validity—we should still prove that the difference of price of gas is disproportionate; the objection, however, does not hold good at all. It must be remembered that during the production of gas there are also developed a large number of collateral results, such as coal-tar, ammoniacal salts, coke, &c.; which results, on account of the higher price which they fetch in London than in Manchester, reduce, in effect, the ultimate cost of metropolitan gas below the provincial standard.

The common councilmen seem to indicate that they will be their own gas-makers. One gentleman alone, as will be seen by our report, desires, as a preliminary, to be put in possession of the opinions of the scientific men on the subject, fearful lest the promises of cheap gas may not be substantiated. Now, let us assure the Common Council that the greater part, if not the sum total, of the expenses incurred by the London companies is defrayed by the collateral products of their manufacture, and that the ultimate price of the gas is almost clear gain. The Common Council, then, need not fear manufacturing their gas at 4s. the 1,000 cubic feet.

Not content with very large peculations, of a kind that we cannot term dishonest, but assuredly unfair, the gas companies, generally speaking, have committed a *lache* of some gravity. The non-chemical public may not be aware that from similar quantities and similar kinds of coal different qualities of gas may be made by mere adjustment of the distillatory temperature. The lower the temperature, within certain limits, the better the gas, and *vice versâ*. Now, it is a device well known to certain gas companies to prepare a portion of good gas for use in the earlier parts of the evening and night, when many eyes are on the watch, but also to prepare a larger portion of gas, which is bad, for late night duty and other times when remarks are not likely to be challenged:—thus perpetrating a direct fraud on the public.

Let the Common Council persevere; if they require scientific guidance it will be easily procured; but we cannot see the necessity of any evidence more definite than that supplied by the gas-manufacturer of the Eastern Counties Railway.

THE CHOLERA.

The return of births and deaths registered in the metropolitan districts during the week ending on Saturday, the 11th inst., was, on Tuesday, the 14th inst., published, according to authority, by the Registrar-General.

The number of deaths in these districts during the last week was 1,165, while the weekly average of the deaths in the corresponding week of the five preceding years was 1,154. In the return for the week ending the 4th inst. the average number of deaths in the metropolis was at 1,115, for the previous week at 1,107, and for the preceding one at 983; hence it will be seen that there has been a considerable increase in the number of deaths within the last few weeks, and more especially during the last week, when the number surpassed the average for this period of the year for a series of years past. The return of the number of deaths from cholera is nearly the same as that of the previous week; last week 62 deaths were registered from this cause, against 65 in the preceding week, and 34 in the week before, whilst the weekly average for cholera at this season of the year is only one. Of those who died from cholera during the last week 28 were under the age of 15; 27 were between the ages of 15 and 60, and the remaining seven cases were above the latter age: of these 29 were males and 33 females. The return demonstrates that a very large proportion of the number of deaths from cholera occurred in the districts to the south of the Thames. It appears that only 11 deaths from the malady were registered in the districts north of the Thames, whilst 51 were registered in those to the south of it. In other diseases of an epidemic or endemic character there has also been a considerable increase beyond the average. The return gives the number of deaths from smallpox during the last week at 34, while the average for the corresponding week of the last five years was 19; from scarlatina, 135, against the average of 47; from diarrhœa and dysentery, 33, against the average of 26; from typhus, 65, against the average of 50; and from puerperal fever, 10, against the weekly average of 0. There has, however, been a great diminution in the mortality from other diseases placed under the same class.

On Tuesday, the 14th inst., the Bishop of London issued to the clergy of his diocese a pastoral letter on the subject of the cholera.

The epistle teems with sentiments of the purest philanthropy, and contains many hygienic suggestions that would do honour to any guardian of the public health.

Our space will not permit an insertion of his lordship's letter in full, but we extract the following passages:—

"It is abundantly clear, from the inquiries which have been made during the last few years, that the most powerful predisposing causes and aggravations of disease amongst the poorer inhabitants of our great towns are, in the first place, a want of cleanliness, and in an inferior degree intemperance, and an insufficiency of wholesome food.

"With respect to intemperance, no fact was more clearly proved than this, during the prevalence of the cholera in this country, that it found its readiest and most helpless victims amongst the votaries of drunkenness or vice.

"But as a preservative from this, as from every other epidemic disease, cleanliness is even more important than temperance; more important, because the want of it is more extensively mischievous. The intemperate man is rendered liable, by his vices, to fall an easy prey to disease. The evil cuts short his single life, and is so far personal only. But it is the property of uncleanness to propagate itself and its injurious consequences. A drunkard may be indirectly the cause of his own untimely death, and there the mortality ends; but an uncleanly person will live in an uncleanly habitation, and that person and that habitation will be each a *fomes* of disease and infection when sickness comes—a centre of contamination and death to a whole neighbourhood, and with this additional and fatal peculiarity, that uncleanness speedily converts the milder form of disease into the more malignant. The dirtiest neighbourhoods were, in every case, those where the cholera first appeared, and where it assumed the most fatal type; nor were instances wanting where it broke out to all appearance spontaneously, with no discoverable existing cause but that of extreme filth.

"It is stated by the sanitary commissioners that whereas, when it previously visited this country, it was believed that the most powerful predisposition to this disease is induced by improper or deficient food, and that for this reason its chief victims are found amongst the poor; it is now universally admitted that a far more powerful predisponent is the habitual respiration of an impure atmosphere, that the highest degree of susceptibility is produced where both these conditions are combined; that is, where the people live irregularly, or on unsuitable diet, and at the same time filthily; and that in places in which a great degree of cleanliness is maintained the poor, as well as the rich, enjoy an exemption from this disease; that, on examination of the actual state of the back streets, lanes, courts, and

alleys of the metropolis, it is found that in general little or no improvement has taken plaec in their sanitary condition since the prevalence of cholera in 1832, and that, were this disease to break out again in the present state of these localities, there is no reasonable ground to suppose that the pestilence would not spread as extensively and prove as fatal as on its former visitation.

"These statements, which are borne out by abundantly sufficient evidence, appear to me clearly to point out a line of duty for the parochial clergy, in which they may render themselves eminently useful, and which is surely in close correspondence with the nature of their offiee as the ministers of a gospel of love; for, if to visit a sick parishioner, and to minister to his reeovery, be one of their plainest duties, it is a still more blessed work of charity to rescue, under the blessing of God, whole masses of their poorer brethren from the inroads of disease.

"You possess, from the nature of your duties, a larger experience than almost any other persons of the actual state of the dwellings of the poor, and of the nature and extent of that evil which is sometimes, no doubt, the result of their own ignorance or carelessness, but much more frequently, at least in the metropolis and the great towns, of deficiencies which they have no means of supplying, and of obstacles to cleanliness which it is the duty of other persons to remove.

"The poor of this country are not by nature nor inclination indisposed to cleanliness; on the contrary, it is almost always found that if its means and applianees be placed within their reaeh, so as to be accessible without much cost or trouble, they gladly avail themselves of them; and it is never to be forgotten that if thousands and tens of thousands of our fellow-Christians are at this moment living, and that, too, in the very neghbourhood of our most sumptuous palaces and halls, in the extreme depths of physical, social, and moral degradation, and exposed to the most imminent danger of perishing by disease, that it is not entirely, often not at all, their own fault; but the fault of those whose duty it is, not only to teach them the benefits of cleanliness and decency, but to do something towards furnishing them with the means of being cleanly and decent, which under their actual circumstances is nothing less than an impossibility.

"Intemperance and filthiness are too frequently the result of want; and, unless something be done for the relief of extreme indigence, it will be an empty mockery to tell those who are borne down and crushed by its weight that they would be less miserable if they were less filthy. Your wealthier parishioners should be reminded that their poor neighbours are in too many cases exposed to the danger of perishing by want as well as by disease, and that if it be a work of charity to protect them, as far as human means can protect them, from the inroads of pestilence, it is still a more sacred and urgent duty to reseue them from death by starvation. But this is so obvious a truth that a passing allusion to it will be sufficient.

"The extreme closeness and inconvenience of the miserable tenements or apartments occupied by the poorest elasses, at rents the amount of which cripples their means of comfort and cleanliness, the inadequate supply of water, the want of all provision for ventilation, the absence of all conveniences for personal ablution and household washing,—these, and the disgraceful state of the sewage in the most crowded parts of the metropolis, are causes which engender or aggravate disease, and hurry great numbers of our fellow-creatures and neighbours to an untimely grave.

"I do not hesitate to express my opinion that such an amount of practical and personal attention to the removal of these evils, as may not seriously interfere with the discharge of those duties which are of a more purely spiritual kind, may be not unreasonably looked for on the part of those whose office binds them to every exertion of charity by which they may promote the present and eternal well-being of the people committed to their care. I lay the greater stress upon this point because it is certain that persons immersed in hopeless misery and filth are, for the most part, inaccessible to the motives and consolations of the gospel.

"Let it then be one object of your pastoral visits to observe the state of the poor man's dwelling, with respect both to its internal economy, and to the condition of its immediate precincts. Call the attention of the proper officers to such cases as may appear to require their interference, and remind those members of your flock whom Providence has entrusted with the means of alleviating the misery of their fellow-creatures that a portion of their charitable expenditure can hardly be more safely or properly directed than towards defraying the expense of cleansing and ventilating the miserable abodes of those by whose labour they are directly or incidentally benefited; and you may add that a very moderate outlay, judiciously made, will accomplish a great deal in the way of such improvements.

"There is another point connected with this subject, respecting which you should instruct and enlighten your parishioners, especially the poorer classes, seeing that ignoranee or misapprehension of the real state of the ease may lead, as it has heretofore led, to a neglect of the most obvious duties of humanity, and to a grievous aggravation of all the horrors of an epidemic disease. I allude to the mistaken opinion as to the supposed contagious nature of the eholera, to which the sanitary commissioners refer in the following terms:—'When cholera first appeared in this country the general belief was that the disease spreads principally, if not entirely, by communication of the infection with the healthy, and that, therefore, the main security of nations, cities, and individuals consists in the isolation of the infected from the uninfected—a doctrine which naturally led to the enforeement of rigorous quarantine regulations, the establishment of military and police eordons, the excitement of panic, and the neglect, and often the abandonment, of the sick by their relatives and friends. Sinee opportunities have been obtained of a closer observation of the eharacter of the disease, and of the mode in whieh it spreads through continents, nations, cities, towns, and families, facts have been ascertained which are incompatible with the foregoing view of its mode of dissemination, and of its prevention. They are of opinion that the disease is not, as it was then supposed to be, eontagious, and that the practical application did no good, but was fraught with much evil.' It is stated by Mr. Greenhow, as quoted by the commissioners, 'that, when several members of one family have been attacked, it has usually been either so precisely or nearly at the same point of time as to forbid the belief of one having communicated the disease to another; and that the true principle of the occurrence of such plurality of eases is to be found in the common existence of predisposing causes, natural or acquired, and a common exposure to the efficient cause of cholera. That in the hospitals at Newcastle and Gateshead, where, were there any such agent as contagion, it must have been present in its most concentrated form, no case has occurred of illness arising from attendance on the sick, either in the persons of the nurses, the resident apothecaries, or the attending, or numerous succession of visiting, members of the medical profession.'"

THE GAS QUESTION.

A meeting of the commissioners of sewers was held on Tuesday, the 14th instant, at the Sewers-office, Guildhall, the Lord Mayor in the chair, "to receive a report from the committee of general purposes in relation to the supply of gas to this city, and to recommend that the necessary notices be given of application to be made to Parliament for the supplying this city with gas."

Mr. Deputy Peacock took the chair, the Lord Mayor having left to attend to his magisterial duties at the Mansion-house, and stated that the committee of general purposes, to whom the gas question had been referred, had taken considerable pains to inquire fully into it. They had been materially assisted in that duty by the City Solicitor, who had given his valuable aid and experience in the drawing up of the report which would be now read. He might add that the result of the inquiry was an unanimous opinion on the part of the committee that the priee of gas was much too high in the City, and that if it was not reduced one way, by the gas companies themselves, it must by another.

The report was then read, as follows:—

"We certify that we have met, and been attended by the City Solicitor, who laid before us a statement which was read to us, and, having considered the plans proposed therein, we recommend to your court, as the only probable means of obtaining a reduction in cost of gas, that notices be at once prepared, and advertised as required, that your court will apply to Parliament for powers to erect gas works, and to lay down pipes and mains, within the City and liberties, with power to purehase the works, pipes, and mains of the existing gas companies, or of any gas company hereafter to be established within the limits aforesaid; and, as the last day for giving such notices is the 18th of November, it is imperative that decision thereupon should be come to immediately."

The City Solicitor's statement was then read:—

"It referred to the eontracts whieh, thirty years ago, the Chartered Gas Company and the City of London Gas Company had entered into for the supply of gas for the street-lights of the city of London, the commissioners of sewers having the power, under the Gas Acts, to purehase from the companies, at the termination of the contract, the pipes, branches, and other material at a fair valuation, or, at their option, to give notice for their removal. The two companies, avoiding eompetition with each other, partitioned out the City between them, an arrangement, in many respects, while advantageous to the companies, was convenient to the citizens. The inhabitants of the City, however, are entitled, from their situation and the extent of their eonsumption, to have a cheaper and a better gas than the inhabitants of the metropolis scattered over a wider district can obtain, because they may be termed wholesale eustomers, and are entitled to have the commodity at a wholesale price. Within the city of London these two companies have derived a rental of upwards of £150,000 per annum from a single set of mains not more than sixty miles in length, the returns thus averaging upwards of £2,000 per mile, whereas the mains of the Chartered, the Imperial, the Equitable, the London, and other companies, traverse many hundreds of miles, sometimes two or three sets of mains in the same streets and roads, without dividing amongst them half such a rental. Gas was formerly sold to the consumer at 8s. per thousand, but now it is reduced to 6s.; the prime cost of the article, allowing for interest on capital expended in erecting, in the factory, and all expenses, and a large and liberal profit, does not exceed 2s. 6d. per thousand. The mains of several gas companies touch close upon the frontiers of the City in various parts; and if the corporation of London, or the commissioners of sewers, under the provisions of the original act, were to purchase the mains and pipes of these companies, now in the ground, at a valuation, they would be enabled to supply the article at a price which would allow of its being sold to the inhabitants at 4s. per thousand cubic feet—a rate which, after making an adequate allowance for all expenses, and interest of capital in outlay for pipes, &c., would leave a considerable balance in aid of the sewers rate, or to defray the cost of sanitary improvements, or any other local improvements that might be desired. If the existing City companies will reduce their

charge to 4s. per thousand there could be no reason for a change. If a combination should be formed amongst the various gas companies to defeat the plan by refusing to tender, their object would not be obtained, for a person largely interested in gas works, and practically acquainted with all the working details of gas manufacturing, had offered to supply the whole quantity required, of the very best quality, as to purity and illuminating power, at 2s. 6d. per thousand cubic feet. Purchasing at this price, the City authorities might dispense the gas at 4s., and collect the rates through officers of the sewers commission, under the management of the commissioners, who might apply the profit in relief of the rates or other important public objects, the commissioners of sewers and the corporation giving their sanction to the City consumers to form a company, to furnish a sufficient capital (£60,000), to lay down mains and pipes, and to contract for the wholesale supply of the quantity required."

The Chairman suggested that, as the court was now in possession of all the facts, some members of it should move that the report should be received.

Mr. Alderman Lawrence owned that the thanks of the court were due to the City Solicitor for the trouble he had taken in the affair, but that they were in possession of the necessary facts to enable them to proceed as recommended in the report he utterly denied; and, before they entered into such a scheme, they should at least have something like evidence to go upon. It was stated that gas could be manufactured at 2s. 6d. per 1,000 feet. It might be so, but there was no evidence on that point yet before them. There were between fifty and sixty miles of pipes laid down in the City. How much money would their purchase require? He was not asking these questions for the mere purpose of raising objections, but for information. If the estimate as to the cost of making gas was correct, no doubt the citizens of London were paying too high a price for that article; but he should be sorry to go to Parliament upon the mere evidence of a letter even from so talented a man as the City Solicitor. If the recommendation were adopted the corporation would become, not manufacturers of gas, but protectors and patrons, as it were, of some gas company, who should supply them wholesale, they retailing the gas out to the consumer. Now, he was not sure that the corporation could properly undertake such a duty—(Hear, hear). It was suggested that, if the corporation could purchase at 2s. 6d., and were to guarantee to supply the consumer at 4s., there would be generally a disposition to contract for five or seven years at that price. But what security would there be in such a contract? For such were the constant changes in a place like London that, in the course of five or seven years, many of the parties would have left or become bankrupt. Again, he was informed that there would be a loss in retailing gas in the way proposed of from twenty to twenty-five per cent. in the quantity, as compared with what they would have to pay for in their wholesale purchase from the manufacturers. He wanted positive information upon this point—also, from the evidence of scientific men, what gas could really be manufactured for per 1,000 feet, and what would be the cost of purchasing the present, or laying down new, pipes. He was delighted with the report as far as it went, but it did not bring conviction to his mind so as to induce him, were he about to deal for himself, and with his own money, to enter upon an undertaking such as that suggested. He hoped, however, that the result of the inquiry would be to open a negotiation which should lead the parties who now supplied the gas to the city of London to reduce their price to, he would not say 4s., but 5s. a 1,000 feet.

Mr. Harrison remarked that if the worthy alderman had attended the committee he would be well convinced that gas could be supplied to the citizens of London at 4s. a thousand, leaving ample margin for profit. With respect to any further reduction in price being made by the two companies who now supplied the City, the court would bear in mind that they were last year distinctly told by the two gentlemen who attended on behalf of those companies that they could hold out no hope of any further reduction; and it was then that the commission felt that they were bound to proceed with the inquiry, which had resulted in the present report. And he was happy to say that he believed the subject was now taken up with a determination to carry it out—(Cheers). An observation which had been made by the chairman of one of the gas companies convinced him that a little more pressure only was needed to bring about a lower price. That gentleman told them that the reason why the company reduced to 7s. and afterwards to 6s. a thousand was because the Imperial Company—which did not come into the City at all—had reduced their prices; and he also stated—and this was still more remarkable—that gas companies which had been long established were not doing so well as new companies. He (Mr. Harrison), from this explanation, came to the conclusion that the new companies were enabled to do better than the old because they availed themselves of all modern improvements in the manufacture of gas, and were not burdened with the excessive expenditure which the old companies had incurred. He had no desire, unnecessarily, to disturb existing arrangements and interests; but knowing that, if the supply was thrown open, the citizens of London might obtain gas at a much lower price than they were now paying, leaving a large sum of money available for City purposes (and it was not impossible, if negotiations were entered into, that the companies who now supplied them might fall in with the arrangements suggested in the report), he felt it necessary, in order to enable the court to act fairly and do justice to their fellow-citizens, that the proper notices should be given of an application to Parliament. Thirty years ago Parliament, in its wisdom, and at the suggestion of that court, inserted a clause in the Gas Company's Act empowering the corporation to purchase the gas-pipes and works at a fair valuation at any time, should they find the supply deficient, or at the termination of any contract; but afterwards, when applying for a bill to raise fresh capital, the gas company had managed to insert a clause rescinding that power. This amount of protection, at all events, they should endeavour to re-establish; let them then give the notices, and they would then be in a better position to negotiate and to avail themselves of any offer that might be made. He would move that the commission agree with the report of the committee, and that the City Solicitor be instructed, immediately, to lodge the necessary notices—(Cheers).

Mr. Deputy Stevens seconded the motion, and referred to the evidence of Mr. Lowe, Mr. Cox, and other gas engineers, given before a committee of the House of Commons, as showing that gas could be manufactured and sold at 2s. 6d. a 1,000, leaving ample profit to the manufacturer.

Mr. Walter observed that sometime ago he had stated to the court that gas was supplied to the Eastern Counties Railway Company at 3s. 6d. a 1,000 feet, and that the party supplying it had laid out £10,000 in the necessary works for the purpose, and had contracted to continue the supply, at the same price, for several years; and he (Mr. Walter) now begged to hand in a letter to the court from a party who would undertake to supply the City at the same price, and to build the works, lay down all the pipes for the purpose, and give ample security for the performance of his contract.

The motion was then put, and carried unanimously.

BRITISH COPPER-SMELTING ASSOCIATION.

Several delegates from various parts of the country, representing different interests connected with the copper trade, held, on the afternoon of Tuesday, the 14th inst., a meeting at 2, Moorgate-street, for the purpose of considering the propriety of forming a joint-stock company to carry on the business of smelting copper ores.

Mr. Wyld, M.P., occupied the chair. He stood there, he said, to represent the miners of Cornwall, who sought to relieve themselves from the evils arising from the whole of the smelting operations of the country being almost entirely engrossed by six really active companies, which now enjoyed an exclusive monopoly from the vast extent of their power and their capital, and by these means were enabled to keep the ore market perfectly under their own control, fixing the prices to be paid to the miner at whatever rates they pleased to allow, and regulating, also, in the same arbitrary manner, the prices at which smelted copper was sold to the public. Though there had been, of late, a considerable reduction in the price of copper, the corresponding reduction in the allowance to the miner had been extremely disproportionate; and, while there had been a recent fall in the market of £10, a deduction of no less than £15 had been simultaneously made from the remuneration of the miner. Now, the object of the scheme they had met that day to discuss was twofold—first, to afford protection both to the miner and the importer of ore by enabling them to belong to a smelting company, where they would participate in the profits arising upon, what must turn out to be, a very remunerative investment for money; and secondly, great benefit would accrue to the public at large from the reduced prices at which copper could be sold. The total amount of pure copper sold in Cornwall and at Swansea during the last three years was 64,574 tons, and the smelter received 21 cwts. in every ton, whilst the returning charge which he made against the miner upon every ton of ore that he purchased was £2 15s., although the operation cost only 15s. of that sum. Sundry other advantages, such as dry-weight, &c., were also enjoyed by the smelter; but the two principal grievances which the proposed company would correct would be to effect a fair purchase of 20 cwts. of ore to the ton, and enable the miner to participate in the enormous returning charges, which, at present, went wholly into the pocket of the smelter alone. The last three years' sales of copper had realized an aggregate of £6,230,084, while the total expense incurred in the production of the commodity was £5,454,795; so that the balance of profit accruing to the smelting companies amounted to no less than £775,289 during the three years, or to an annual net profit of about £258,436. These calculations were based upon Government tables, and set down the profits at a minimum and the expenses at a maximum estimate. Now, if the projected company raised a capital of £150,000 by 50,000 shares of £3 each, he considered that outlay would be amply sufficient to enable them to smelt 500 tons per week, or one eighth of the entire trade, giving a yearly profit of £32,204. He was sure, therefore, if the company were formed, that not only the general capitalist, who sought a profitable investment for his money, but also all parties engaged in mining operations, both at home and abroad, would have a great boon conferred upon them. The importation of copper ore was now almost entirely free, the nominal duty being only 1s. per ton; and, looking at the immense importations from Australia, Chili, Cuba, Peru, and other parts of the world, which were at present steadily on the increase, he considered that no time could be selected more fitting than the present for starting the proposed undertaking, which, he was happy to say, was already favourably regarded by several extensive firms in Liverpool and elsewhere. The Messrs. Brownell, of Liverpool, who were, perhaps, the largest importers of Chilian and Peruvian ores in the kingdom, had signified the probability of their embarking in the project as soon as it had progressed through a few of its incipient stages; and various other houses, also, were inclined to follow their example.

Mr. J. H. Murchison (secretary *pro tem.* to the project), adverting to the prospects at present held out, stated that the scheme would be cordially taken up by influential gentlemen largely connected with the copper trade; and urged that all the great mining companies of the country should be invited to take shares in this company.

Mr. Sharp then moved—"That it is highly important to form a British Copper-Smelting Association, and that for this purpose steps be immediately taken to constitute a provisional board of directors." He said there were three new localities open to the choice of the company for establishing its works, each of which offered advantages infinitely superior to Swansea, where nearly all the existing smelting trade was at present carried on; and where a new company would have no chance of success, as it would be completely overborne by its old-established and opulent rivals.

Mr. Miller seconded the motion; and Messrs. Burgess and English, of Cornwall, who severally bore testimony to the interest taken by the miners of that district in the breaking up of the existing monopoly, addressed the meeting in support of the project; after which the first resolution was unanimously adopted.

Mr. Routh, seconded by Mr. Trennery, then moved—"That provisional directors, with power to add to their number, be elected, to hold office until two thirds of the shares be subscribed for; when a meeting of subscribers shall take place to elect the future directors."—Carried unanimously.

Thanks were then voted to the chairman, and the meeting was adjourned to Thursday, the 23d inst.

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—Without entering into any discussion on the merits of Mr. Thompson's review of the Admiralty coal report, I would merely beg to remark that the "0.2763 of a grain" is a misprint for gramme, which was corrected in the report as published subsequently in the memoirs of the "Economic;" consequently it was about four grains, instead of a quarter of a grain, which was employed in the analyses referred to. This, I find upon reference to the last report, was about the usual quantity of coal operated on in all these analyses. VERITAS.

MISCELLANEA.

SOLUBILITY OF ZINC IN FATTY OILS.—The metal zinc, now so generally used for vessels of capacity, forms, it cannot be too generally known, with fatty bodies a class of remarkably poisonous salts. With olive oil these salts are the oleate and margarate of oxide of zinc. They are not soluble in oil, but remain suspended in the condition of white flocks.

ADULTERATION OF SULPHATE OF QUINA WITH SALICINE—HOW DISCOVERED.—This adulteration is well known to be frequently had recourse to by certain individuals whose position should afford some guarantee of their probity. The fraud may be readily discovered, when the amount of falsification is considerable, by the red colour which sulphuric acid communicates to the mixture. But when the mixture contains below 10 per cent. of salicine there merely results from this treatment a brown colour, such as frequently results when a mixture of foreign organic matters is present. Under these circumstances M. Peltier recommends the suspected mixture to be dissolved in six times its weight of concentrated sulphuric acid, and then to add twelve parts of water, by which process the salicine is precipitated in the colourless state, and may now be recognised by its bitter taste and the red colour which it imparts to sulphuric acid. To discover the existence of foreign organic matters in general present in the sulphate of quina M. Nevias has recourse to the following process. He treats two grains of the salt by three or four drops of sulphuric acid in a porcelain vessel. The pure salt, or its admixture with amidine, dissolves immediately, but the starch and fatty matters remain undissolved. Pure sulphate of quina if gently heated suffers no alteration in colour, whereas organic impurities become charred. In this manner 1 or 2 per cent. of foreign organic matters in sulphate of quina may be easily discovered.

THE SULPHURETTED ESSENTIAL OILS OF CRUCIFEROUS PLANTS.—It is well known that plants of the natural order Cruciferæ yield volatile oils which contain sulphur in a peculiar state of combination. M. Fr. Pless has arrived at the following interesting deductions as the result of his experiments on these oils:—He has discovered that some of the cruciferous plants which are usually thought to contain a sulphurized oil do not really contain it ready formed, but that it is engendered by the influence of water applied during the process of distillation. If the plants or their seeds be heated at a temperature of 100°C. before distillation they produce no oil; if the plants or seeds be long digested with alcohol, the latter contains no oil, neither does any oil result if the residue be distilled with water. Hence phenomena are presented by these cruciferous plants similar with the phenomena developed by bitter almonds under similar treatment. M. Pless, amongst other determinations, desired to assure himself whether there might not exist certain plants capable of yielding artificially the essence of mustard and of garlic. He found that the Thlaspi arvense is thus circumstanced. When this plant or its seed is mixed with water, and, after having been allowed to remain a certain time, is exposed to distillation, a colourless oil of penetrating odour is obtained, having a combined taste of mustard and of garlic. On mixing this oil with ammonia, and, after the lapse of a certain time, water being added, and the whole distilled, the residue deposits in the retort beautiful crystals of thiosinamine, easily distinguished by their well-known properties. If the ammonia which exists in the product of distillation be saturated by sulphuric acid, and the whole exposed to distillation, there pass over, mixed with aqueous vapour, fumes of sulphoallycine (essence of garlic), which may be easily recognised by their immediate properties, and by their combinations with the chlorides of platinum and of mercury. M. Pless, having analyzed the combination with the chloride of mercury, found its composition to be exactly similar to that prepared by M. Wertheim from the essence of garlic. It results from these experiments that the two essential oils become mixed in the product of distillation of the Thlapsi arvense with water. When the seeds of this plant are digested with alcohol, and the solution evaporated, there is obtained a crystalline residue admixed with mucilage; and if now this residue be distilled with water and white mustard, bruised, after maceration there is obtained the essence of mustard without any admixture of essence of garlic. The roots and leaves of the Alliaria officinalis, in which M. Wertheim had suspected the existence of the essence of mustard and of garlic in a state of union, does, in truth, contain both. The essence of garlic may be separated by mixing the oil with water and chloride of platinum. The essence of garlic remains in combination with the chloride of platinum, that of mustard alone passing over. The seeds of Alliaria officinalis produce 3-5ths per cent. of their weight of oil, of which 1-10th consists of essence of garlic and 9-10ths of essence of mustard; in the essential oil of Thlapsi arvense, on the contrary, there exists only 1-10th per cent. of the essence of mustard. These proportions, however, are so far from invariable, that the Alliaria, which grows in a situation very much exposed to the sun, does not contain a single trace of the essence of garlic. The plant and seeds of the Iberis amara furnished by distillation essence of mustard unmixed with that of garlic, which was also obtained, but in very small quantity, from the plant and seeds of the Capsella bursa pastoris, from the Raphanus raphanistrum, and the Sisymbrium officinale. The Lepodium ruderale contains a sulphuretted oil different from those which have been already described. When this plant is submitted to distillation with water, there is obtained a milky product, which after some rectifications leaves a residuary yellow oil. In conducting this distillation it is necessary to avoid the use of copper vessels, which decompose the greater part of the oil: the distillation should be conducted in vessels of glass. It is necessary, moreover, to avoid a prolonged maceration of the plant in water before distillation, for at the end of six hours the oil disappears altogether. This oil possesses the peculiar odour of watercresses (mixed, however, with that of essence of garlic), and a piquant taste. Respiration of the vapours produces headache, and a sensation of dryness in the throat. By oft-repeated distillations with water it may be obtained in a colourless state, but exposed to light the colour speedily returns. Distilled alone it is decomposed; it is sparingly soluble in water, but very soluble in alcohol and ether. These solutions are without any action on turmeric paper. They dissolve in sulphuric acid with the production of a red colour, and may be separated without alteration by the cautious addition of water. Caustic ammonia and caustic potash do not attack it. The alcoholic solution of this oil, being treated with chloride of platinum, deposits an orange, and with chloride of mercury a white, precipitate. Treated with nitrate of silver, there are obtained at the same time—a precipitate which is white and another black (the sulphuret of silver). Nitric acid decomposes it, and the solution then produces with chloride of barium a precipitate of sulphate of baryta. The same oil may be extracted from the seeds of Lepidium sativum and Lepidium campestre. The latter yields a good deal, but with difficulty, because the water in the retort becomes mucilaginous, viscous, and thick, during the process of distillation. The roots and seeds of Raphanus sativus produce by distillation a milky fluid, from which may be extracted by the process of rectification a small quantity of colourless oil which possesses a taste, but not an odour, similar to that of radishes; this oil, in like manner, yields a yellow precipitate with chloride of platinum, a white one with bichloride of mercury, and sulphuric acid when its sulphur has been oxidized by treatment with nitric acid.

CEMENT FOR ATTACHING METAL TO GLASS OR PORCELAIN RECOMMENDED BY M. HERBERGER.—Take two ounces of a thick solution of glue, and mix with one ounce of linseed oil varnish or three quarters of an ounce of Venice turpentine. Boil together, agitating until the mixture becomes as intimate as possible. The pieces cemented should be held together for the space of forty-eight to sixty hours.

PROCESS OF SILVERING MIRRORS BY REAL SILVER.—Dissolve five grains of nitrate of silver in a little ammonia, then mix with the solution a drop of oil of cassia and two drops of the oil of cloves in one or two drachms of concentrated alcohol. This mixture soon becomes turbid, and throws down a precipitate which must be separated by filtration. This being done, the liquor is immediately spread over a layer of glass, well cleaned, and furnished with a rim to prevent the running away of the liquor. After some hours the glass becomes covered with a metallic pellicle, which adheres firmly to it. The proportions just indicated are sufficient for a surface of sixteen square inches.

REFRACTORY CLAY FOR CRUCIBLES; ARTIFICIALLY PREPARED.—Manufacturers frequently learn, to their cost, that certain kinds of clay will not sufficiently stand the action of fire to become useful in many melting operations. Their fusibility depends on the presence of lime, magnesia, oxide of iron, and occasionally a few other materials, the greater number of which can be removed by washing the clay with hot hydrochloric acid, after which the mass is to be

washed with water and dried. With clay thus prepared, crucibles may be made that will not soften when forged iron is melted in them.

Modification of Oil of Turpentine which dissolves Caoutchouc easily, and evaporates without leaving a Smell or Adhesiveness.—It has been demonstrated by MM. Guibourt and Bouchardat that under the general appellation of oil of turpentine are comprehended several isomeric compounds (*i.e.*, compounds of identical composition), manifesting peculiar actions on a ray of polarized light. For example, in the oil of the Pinus larix, P. maritima, P. argentea, and P. Europea, and most other of the European species, the deviation or deflection of the plane of polarization is towards the right, that produced by the turpentine of the P. larix being the most feeble. An oil of turpentine much used in Britain, and obtained from the Pinus tæda, an American species, deflects the plane of polarization as much towards the right as that of the P. maritima does towards the left; and this, notwithstanding the crude turpentine from which it was extracted, caused an equal deviation towards the left. These variations of agency upon a ray of polarized light indicate, by sufficient evidence, that under one denomination there really exist many isomeric bodies, and that an oil of turpentine very well adapted for one purpose is unfit for others. M. Bouchardat has discovered that oil of turpentine distilled alone, that is to say, without the presence of water, deflects the plane of polarization more towards the left than if the turpentine had been distilled in contact with water. If a portion of turpentine be absorbed by pieces of brick or porous ware, and then distilled, the result is a substance considerably modified from the original, being yellow, and possessing a mixed odour of lime, oil of naphtha, and oil of turpentine. Its specific gravity is more feeble, namely, 0.842 instead of 0.8736, and its boiling point being reduced to 154° C. from 156° C. or 158° C. (equal to 232°, 235°, and 237° F.), and its power of deflecting polarized light to the left being diminished to the extent of one half. In order to ensure its maximum alteration it is necessary to submit the oil to a second treatment of the same kind, because one part is transmitted without change. During this second distillation there becomes formed an oil which is much more volatile than the rest, and which causes the general liquid to boil at a temperature of 80° C. = 145° F., but the quantity being inconsiderable the boiling point soon remounts to 154° C. = 232 F. The oil of turpentine thus modified possesses the same composition as before, but it has acquired a property which it did not originally possess, viz., of dissolving caoutchouc, and evaporating without leaving the latter gummy or odorous. Another excellent plan of dissolving caoutchouc is as follows, and was discovered by M. Boettger: — Introduce small fragments of caoutchouc into a flask, to the extent of two thirds its capacity, cover the indiarubber with rectified petroleum, and let it macerate for eight or ten days; now decant the petroleum, fill the flask with a mixture of ether and sulphuret of carbon, of each equal parts, and cork the flask. The contents are to be agitated for many days, and then allowed to repose. When the mixture has become separated in two layers, the upper layer, which is slightly viscous, is to be decanted into another flask and kept well closed. This liquid, which holds caoutchouc in solution, answers every purpose to which a good solution of that material can be applied. It dries rapidly, and, after evaporation, deposits the caoutchouc in possession of all its original properties. It is of great service in the laboratory for making tubes of caoutchouc, and for repairing bottles, balloons, &c., of the same material.

Mr. Thomas Hennesy on a Chemical Tube-Slide.—All who are much occupied in the laboratory have felt the want of a ready means of adjusting the length of glass tubes conveying gas from a generator into a second vessel. The usual plan of adjustment consists in elevating or depressing the whole apparatus by means of blocks or similar contrivances; but frequently this plan, from its general rigidity, occasions much trouble. I am in the habit of obviating the difficulty as follows:—I cut a portion of vulcanized indiarubber tube into lengths of about two inches, one end of which I draw over the extremity of the larger tube, and, having moistened the smaller tube to make it run easily through the rubber, whilst pressing upon it I thrust it through the other end of the indiarubber junction-tube into the large glass one. By this means a slide similar to that of a trombone is formed, which may be adjusted to the minutest fraction of an inch, and is perfectly trustworthy.

APPLICATION OF POPLAR BUDS TO MEDICAL USE.

The buds of the poplar (Populus nigra) are used in medicine on account of the resinous matter which they contain.

According to Pellerin's analysis they contain:—

An odorous essential oil,
A greenish-yellow resin,
Gummous extract,
Gallic acid,
Malic acid,
A fatty matter greatly resembling wax,
Albumen,
Acetate of ammonia,
Hydrochlorate of ammonia.

Alcoholic tincture of poplar buds.

Take of Fresh poplar buds, 1 part.
Alcohol of 80° (31° Cartier), 6 parts.

Macerate for fifteen days; strain with expression, and filter.

Pomatum of poplar buds.

Take of Dry poplar buds, 1 part.
Hogslard, 4 parts.

Digest in the water-bath, or over a gentle fire; strain with expression, and remove the dregs.

This pomatum is recommended against hemorrhoids.

Poplar ointment.

(*Unguentum populeum.*)

Take of Dry poplar buds, 3 parts.
Green leaves of poppies,
" belladonna,
" hyoscyamus,
" morel, of each 2 parts.
Hogslard, 16 parts.

Bruise the leaves and put them into a pan, together with the hogslard; boil until all aqueous moisture is completely expelled; add now the pounded poplar buds, and keep the mass digesting for twenty-four hours; strain with expression, let the mass settle and cool, and remove the pomatum in layers by cautious scraping, to separate it cleanly from the dregs; or, better still, reverse the cold mass and scrape the dregs off the bottom.

TO CORRESPONDENTS.

We feel great pleasure in being able to announce to our readers that arrangements have been made for the speedy appearance in our columns of a series of lectures by Dr. Sheridan Muspratt, of the College of Chemistry, Liverpool. Numerous and repeated suggestions from many of our correspondents (whose wishes we shall always study to fulfil) have induced us to make the above-mentioned arrangement.

Mr. Burnard, of the South Down Chemical Works, from whom we were promised the first paper of a series in the current number, has addressed us a note expressive of his regret that a pressure of business will prevent his arrangement of the necessary MS. for a few weeks.

Mr. M'Mahon desires us to recommend him a popular treatise for instructing him in those general problems of mensuration which relate to the cubic measurement of tanks, both rectangular and cylindrical. We would recommend to our friend "Templeton's Workshop Companion," and "Barlow's Tables of Squares, Cubes, Square Roots, Cube Roots, and Reciprocals."

"Mr. Nicholas Barton."—At present no lectures are regularly delivered at the Royal College of Chemistry. Measures, however, are being taken to superadd this method of instruction to the methodical laboratory course of practical chemistry which every pupil in that admirable institution now pursues. For our own part we think lectures, as compared with a practical course of analysis, is a very secondary matter.

"Electricus."—We intend publishing an article on Staight's electric light, perhaps in our next number. We do not know the composition of baking powder.

Mr. E. H. Durdon's communication has been received.

Mr. Jones, wine-merchant, near Albert-gate, has sent us a sample of pale brandy for our opinion. We pronounce it to be remarkably good and pure, free from that disagreeable empyreumatic odour and taste which all dark-coloured brandies possess.

"J. T., Devizes."—Boiled linseed-oil, without any adjunct whatever, is sufficient for making oiled silk. The silk should be strained on a frame, and the oil laid on with a brush.

T. H., of Shoreditch, sends us a letter in which he remarks that certain queries addressed to the editor of the *Pharmaceutical Times* have not been answered. We beg most emphatically to assure our correspondent that his letter never came into our hands, or it would have received prompt attention. If he will address his queries to the editor of the *Chemical Times*, 320, Strand, he will be answered (if possible) forthwith.

A correspondent requests us to tell him what will make his hair curl. This, we imagine, must have been intended as a joke. Our knowledge of the barber's art is less extensive than he imagines.

Chemicus, of Heckmondwike, writes to us desiring our opinion as to the safety of employing chloroform as an anæsthetic. This we have no difficulty in giving him. Chloroform has now been used somewhat more than twelve months for the above purpose, and a careful review of the circumstances attending on several fatal cases warrant us in decidedly repudiating any employment of the agent, except on grave emergencies. To allay pain during such a trivial operation as the extraction of a tooth is improper in the extreme.

"Mr. J. Reynolds, Truro."—We have carefully examined a list of chemical patents on the subject of manures, extending over many years, up to the year 1846, without finding any relative to the specific use of fish as manure. In 1842, however, a patent was taken out by Mr. Albert for the preparation of flesh tendons, &c., as manures. A list up to the present time of patents taken out is being published by Mr. Carpmael.

"N. Palmer."—Caffeic acid is obtained by precipitating an infusion of caffeine by means of acetate of lead, mixing the precipitate with water, and decomposing by means of sulphuretted hydrogen. The filtered liquid is evaporated to the consistency of a syrup, and then mixed with its own bulk of alcohol. The portion held in solution by the alcohol is tanno-caffeic acid, the portion thrown down is caffeic acid.

"Mr. Henry Parsons, Bangor."—Cinchonia was discovered in 1820 by Pelletier and Caventou in the grey Peruvian bark, not the red, as Mr. P. supposes. This grey bark is supposed to come from the Cinchona nitida or C. condaminea. Probably the celebrated Loxa cinchona contains the same principle. The following process of extraction was had recourse to by Pelletier and Caventou:—4 2-5 lbs. avoirdupois of grey bark in powder were digested in 13½ lbs. of alcohol. This treatment was repeated twenty times. The alcoholic tincture being decanted, the alcohol was distilled off after the addition of 122 cubic inches of water. The residual liquor being filtered left on the filter an apparently resinous matter: this was washed with water containing a little potash, until the liquid passed without colour. The matter remaining on the filter after being well washed with distilled water is greenish-white, fusible, soluble in alcohol, and crystallizable. It is cinchonia.

Mr. Preston, who sends us a long list of subjects on which he can write articles for our pages, in consideration of an adequate remuneration, is informed that we in general do not like to have any connection with gentlemen who can write on any subject. One subject is enough for one individual to excel in. If Mr. Preston can convince us that on any one subject (adapted to our pages) he is in a position to send us good articles, there will be no difficulty experienced on the point of pecuniary remuneration. Let him send us a specimen, with a statement of the fee he expects.

"Mr. P. Outram."—In proportion as water is pure the more readily does it act as a solvent for lead. Hence this practical deduction may be gleaned—not to use leaden tanks for rain-water, nor for spring-water, which contain but small amounts of foreign bodies. A small pinch of common salt added to rain-water in a leaden tank completely obviates all danger of solution.

"Mr. W. Markham."—The gas blowpipe used in the autogenous soldering purpose is admirably adapted for brazing, but the heat produced by it is too violent for glass-blowing purposes.

"Mr. Noad" shall receive a private answer from us.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to annual subscribers sending a Post-office order directed to Robert Palmer, or an order on some party in town, for one guinea in advance, which will ensure the journal for twelve months. Half-yearly subscriptions, 13s.; quarterly, 6s. 6d. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—November 18, 1848.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Before entering upon the composition, properties, and products of decomposition of organic substances, it appears desirable to premise a few remarks relative to the bearings of chemistry generally, upon its relations to other sciences, and its vast utility in all departments of life. A knowledge of chemistry extends our acquaintance with Nature and her laws, so that we are enabled, in numberless instances, not only to apply to the most profitable purposes such information, but to determine antecedently, with sufficient accuracy, the termination of every new application. In fact, the objects of chemistry are inexhaustible; for it ventures to examine the matter of which trees, rocks, vegetables, animals, and even the atmosphere, are respectively composed; it seeks to ascertain their qualities, the number of their elements, the idiocrasy of these, and the properties of every other compound produced by their union;—consequently demanding, on account of its vast utility, the notice of mankind. Its usefulness, often unacknowledged, is everywhere felt. What immense influence does it not exercise upon geology, geognosy, the manufacturing of soda, soap, borax, alum, glass, sulphuric acid, porcelain, &c.? Even baking, brewing, distilling, dyeing, bleaching, depend entirely upon chemical principles; and, as to the advantages arising from its applications to agriculture, these are daily becoming universally allowed. Liebig has done more, practically, for the world by impressing upon it in his admirable letters the necessity of a knowledge of this science, than by all his brilliant discoveries. Through his instrumentality it is becoming a necessary part of education. This is proved by the establishment of schools of chemistry in different parts of the kingdom, whence a generation must spring up qualified to accomplish great improvements, and to produce fruits of universal profitableness. Chemistry, although yet in its infancy, has contributed more to the progress of society, to the augmentation of the comforts and conveniences of life, and to the resources of mankind, than all the other sciences put together; and the time is not far distant when it will be considered by all ranks in its true point of view, *i.e.*, as the refinement of common sense guided by experience, substituting sound and rational principles for vague popular prejudices. Having prefaced this lecture with a few remarks upon the paramount utility of chemistry, we will now proceed to that department of the science which treats of the composition, properties, and uses, as well as of the origin, of all matters produced in the vegetable and animal kingdoms, and of the artificial bases, acids, and other compounds emanating from their disintegration. All organic products contain a large quantity of carbon combined chiefly with hydrogen, oxygen, and nitrogen, so that these four elements have been called the organic elements. It would be a great mistake to suppose that carbon, hydrogen, nitrogen, and oxygen are the only elements essential to the existence of organized beings, because potassium, sodium, calcium, magnesium, iron, phosphorus, silicom, sulphur, chlorine, and iodine are constantly found in plants and animals. Manganesium and aluminum have been stated to exist in plants, but they are accidental constituents, and not essential to the existence of the organized bodies in which they are found. It has been infallibly proved that without a certain number of the above elements no plant or animal can exist. Phosphorus is one of the chief ingredients of bones. This element, when combined with oxygen in certain proportions, forms an acid, which, with oxide of calcium or lime, affords phosphate of lime, invariably found in the largest proportion in the seed of plants, and is indispensable for their production. Appearing in the various graminæ, it serves an allwise purpose of the Great Disposer of events, namely, that of furnishing to animals the principal material of which their framework is formed. Without silicate of potassa none of the cereals could grow. The grain of wheat contains no silicic acid—a compound of silicium and oxygen—while incinerated wheat straw yields eighty per cent. From these data we know that the most abundant supply of the four organic elements cannot support either animal or vegetal life, unless collaterally aided by some of the inorganic elements. Organic and inorganic chemistry are so intimately allied to each other that in some cases it is a most difficult problem to separate them. In fact, they are daily becoming more amalgamated; and the more the theory of radicals, compound radicals, and basyles is studied and extended, the more closely will the compounds in the organic appear analogous to those in the inorganic world. By the term compound radical we mean a certain class of compound bodies having the property of uniting with elements, forming with them combinations similar in their behaviour to the combinations of two simple substances. The great desideratum at the present day is to properly classify the myriads of substances that have been described, and especially in organic chemistry; but this cannot be thoroughly accomplished until our knowledge of the science is more complete. We assume many radicals in chemistry without knowing that they really exist. This procedure, even if considered in no other light than as an aid to the memory, is extremely important, as it enables us to show to the student at a glance the decompositions and recompositions occurring in experiments brought under his eye. I have found it very useful in my laboratory, and the pupils are astonished, owing to its simplicity, that it is not universally adopted. My esteemed friend Dr. Hofmann, of the Royal College of Chemistry in London, is one of the foremost in propagating views with regard to the correct nomenclature and composition of organic and inorganic bodies.

[*To be continued.*]

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B. Lond.,
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 16.]

The usual method of obtaining the juice of the cane is, as it has already been observed, by the pressure of iron cylinders, constituting in the aggregate the sugar-mill. Other plans have been devised of a more elaborate character, and which will be hereafter described; there are others, again, which, instead of being more elaborate, belong exclusively to imperfectly civilized races. Thus the natives of many parts of India use for the purpose of extracting the juice from the cane a gigantic pestle and mortar of hard wood. This machine is taken into the field where the canes grow, and the pestle worked by cattle-power, the juice as it is expressed being allowed to run away from time to time through a hole communicating with the lowest concave portion of the mortar.

Whatever the nature of the machine employed, the main object of this operation evidently must be to express as much as is practicable of the juice. Now, repeated experiments have demonstrated the fact that the average ratio of juice to woody fibre in the cane is as 90 to 10; in other words, these exist 90 per cent. of the former and 10 per cent. of the latter. Nevertheless, it is affirmed by most competent authorities that, taking the average result of our West India colonies, scarcely more than 50 per cent. of juice is in practice obtained; thus the loss of sugar, by imperfectly conducting this apparently simple mechanical operation, is something enormous.*

Many circumstances conspire to prevent the whole 90 per cent. of juice being extracted. Of these the want in general of sufficient motive power to works mills of which the cylinders approximate beyond certain limits is the most obvious; and without the process of washing the crushed canes with hot water, which is clearly impossible in practice, the whole of the juice (however perfect the machinery) could in no case be extracted.

Strangely enough, many West Indian proprietors have objected to employ the greatest amount of pressure obtainable from existing mills and their motive powers, on the ground that, if all the sugar were extracted from the canes, the resulting cane trash or megass would not burn sufficiently well to effect evaporation of the juice already expressed!

Without stopping to comment on the folly of growing sugar to be used as fuel, whilst coal can be employed at a comparatively moderate rate, we shall speedily arrive at the result that the sugar thus purposely allowed to remain in the cane is wholly lost. Fermentation almost immediately sets in, and long before the canes are dry for fuel the sugar which their tissue contains is altogether decomposed. The series of pans now used for the boiling of sugar-cane juice being hung usually over one fire, coal would not serve for the evaporating agent, some flaming substance being required to afford a more extended blaze. All competent parties, however, agree that this existing plan of arranging the sugar plant is most injudicious, and cannot be too speedily altered for a series of pans each on its separate fire.

The juice, as it comes from the cane, is far from a solution of sugar and water, as I have already observed, being admixed not only with chlorophyll, mucilage, vegetable albumen, and various other organic and inorganic impurities, but also containing a mechanical admixture of fragments of cane trash and broken leaves.

Cane-juice, when recently expressed, is an opaque, frothy liquid, of a yellowish or greenish colour. Its taste is aromatic and sweet, its smell agreeable. Tested by litmus paper, it manifests an acid reaction.

The extremes of its specific gravity are 1046 and 1110, equal to 7° to 15° of Baumé's scale, but generally its specific gravity fluctuates between 1070 and 1090, equal to 10° and 13° of the same scale. A specimen of cane-juice which I succeeded in obtaining from the island of Barbadoes, in May, 1848, posssessed the specific gravity of 1090, equal to 12 of Beaumé's scale, and indicative of the presence of 22 per cent. of sugar, a quantity which, within a trifle, I succeeded in extracting from it.*

The juice, having been extracted by the agency of the mill, is now allowed to fall into a large reservoir of copper or iron, called the receiver, and thence from time to time is pumped or otherwise conveyed into another vessel, where it is subjected to the important operation termed defecation or clarification. This operation consists in the employment of a certain portion of cream of lime, at a temperature of about 180° F., in order to effect a chemical change, followed by a mechanical separation of the foreign impurities, in cane-juice.

Now, from what has already been stated re-

* A few years since M. Duprez, a pharmacien of the French marine, was sent by his Government to Guadaloupe for the purpose of performing a series of experiments on sugar-cane and cane-juice. He found that the amount of juice extracted from 100 lbs. by various mills was as follows:—

1.	By mills having horizontal rollers; the motive power not stated	61.2 lbs.
2.	By mills; motive power, steam	60.9
3.	By mills; motive powers, wind and steam	59.3
4.	By mills having vertical rollers	59.2
5.	By mills; motive power, cattle	58.5
6.	By mills; motive power, wind	56.4

* The reader may be interested to learn the method had recourse to for enabling the juice to be conveyed to England unchanged. The attempt had often been made before, but unsuccessfully. Being aware of the efficacy of sulphurous acid gas in preventing the fermentation of vegetable bodies, it was thought that cane-juice fresh from the mill, if impregnated with this gas, and then put into well-corked jars, might probably arrive in Europe unchanged. The anticipation was verified, and crude cane-juice (for the first time) was brought to Europe in an unfermented state.

lative to the agency of lime on pure sugar, it is evident that the alkaline earth should be employed with great care and caution. If possible, the amount theoretically proper for effecting the desired change in the chemical impurities should not be exceeded, or, if impossible, such excess should be confined to the narrowest possible limits.

Unfortunately the most skilful chemist, to say nothing about colonial sugar-manufacturers, would feel the exact apportionment of lime to the existing impurities to be altogether impossible, and would be only able to keep within the bounds of a loose approximation by the most diligent testing for any alkaline reaction.

The way in which the operation of apportioning the amount of lime, or tempering, as it is called, is this:—In the boiling-house is arranged a row of wine or test glasses, each containing a portion of the juice to be tried. Into each of these glasses simultaneously the boiler, usually a negro, pours a little cream of lime, and agitates the mixture. Immediately the lime and the cane-juice come into contact, a yellow colour, more or less pronounced, sometimes even verging towards red, results. The eye of the boiler decides as to which glass shows the best result, and, that point being determined, the operator proceeds to treat the bulk of corresponding cane-juice with a similar amount of temper lime. A great deal of mystery is associated by various manufacturers with the mode in which the lime is to be added to the cane-juice. Although lime, when skilfully employed in the sugar manufacture, exerts a great purifying agency, yet, even under these, the most favourable, circumstances, its injurious action on the sugar itself is well known, and generally admitted. To diminish the amount of this injurious agency, some colonial sugar-producers incorporate the temper lime with a portion of sugar solution, and add it to the juice to be defecated in this state. Others are content with merely incorporating the alkaline earth with water. In either case it may be safely pronounced that the results are identical, for the opinion is altogether invalid that a portion of lime being already incorporated with sugar has effected its maximum injury, and may be thereupon used with impunity. Lime, no less than any other agent, to be useful must have a potency, and, in proportion as such incorporation might diminish that potency, so would also be diminished its purifying as well as its destructive effect.

The juice in the defecator, having been treated with the predetermined amount of lime, is rapidly brought to the temperature of 180°, or sometimes higher. The boiling point, however, should not be achieved. The result of this heating is as follows:—The lime, by exercising some powerful chemical agency on the vegetable albumen and its numerous organic associates, causes a thick scum to rise to the surface of the heated liquid. This scum at length cracks in various parts, which is usually considered a sign that the heating has been sufficiently prolonged. From time to time the scum as it arises is removed, when the liquor underneath is seen to have undergone a considerable change. Instead of the greenish-yellow tint which exists when expressed from the cane, its colour is now heightened, it is less mucous to the feel, and it has also become altered in smell. The process of concentration now commences, and, as the means of accomplishing this end vary in different colonies, and in different plantations of the same, it will be necessary to offer such general remarks as shall equally apply to all cases.

If the operation called defecation had really succeeded in effecting a total separation of all impurities, the subsequent stages of the operation would be simple enough. The purified liquor might be transferred into appropriate vessels, and evaporated by some means at the lowest temperature consistent with commercial necessities. Such perfect defecation, however, cannot be accomplished by lime—hence the liquid, already partly purified, will still, on boiling, throw up a large amount of scum, which it is imperative to remove. Hence the necessity, were there no other, for a large amount of boiling surface from which this scum may be easily taken off. So various are the arrangements of boiling-pans in different parts of the world, that it would be a task no less endless than useless to attempt their enumeration. It will be sufficient, therefore, to indicate that the object strived to be attained is the same,—namely, to furnish a large extent of boiling room.

As the canes from which the juice has been expressed, cane trash, or megass, as it is called, is used for fuel; the necessities of the case have obliged the colonial sugar-boiler to bring his range or batteries of boiling-pans over one long flue in such a manner that the hottest part, or common current of the flame, is situated under the last boiling-pan, called the *teache*, in which the sugar-cane-juice acquires its maximum of condensation. Thence the flame plays to the under end of the series as far as the last pan or clarifier, and then ascends the chimney. The inconveniences attendant on this plan will be evident on consideration; indeed many colonial sugar-producers have so far recognised the fact that an alteration has been made in the plant to the extent of using a separate fire for the clarifier, the vessel in which, of all the lot, the nicest adjustment of temperature is required.

The process of boiling is one of more simplicity than worth. By each pan stands a man, whose duty it is to remove the scum as it rises to the surface, and to ladle a portion of the boiling solution occasionally from one pan to the next.

Eventually the juice, already considerably thickened by evaporation, arrives at the final pan, called the teache, where it is brought, by the further application of heat, to the required degree of concentration. To ascertain this required degree is a matter of some little judgment, which can only be acquired after much careful observation. The operator from time to time drops a portion of the boiled syrup on his thumb, and, approximating the thumb and forefinger, quickly separates the two. Accordingly as a string is formed, which may present certain appearances, quite impossible to be described, and breaks at a certain length, the boiling is pronounced sufficient, too much or not enough. If sufficient, the mass of concentrated syrup is rapidly ladled into shallow wooden troughs, called coolers, where crystallization is permitted to ensue.

The reader is requested to amend the following errata in the last article on sugar by Dr. Scoffern:—P. 15, line 33 from bottom, col. 3, for absorbed read colourless; p. 16, line 27 from top, col. 1, after sacchumic read acids.

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXIII.

(LECTURE LXI.)

FATS AND FIXED OILS—(*Continued*).

MEDICINAL USES OF FATTY SUBSTANCES.

Fats and fixed oils are put to a variety of uses in medicine; they are frequently used for embrocations (olive-oil, hogslard, croton-oil), or as suppositories (cacao butter). In the preparation of medicinal oils they serve as solvents and vehicles. They form, also, an essential ingredient of pomatums and cerates. We associate them with various substances to facilitate their administration; thus, for instance, we dissolve croton-oil in alcohol, or mix it with sugar, or make it into pills; we use cod-liver oil in form of syrup, cacao butter in form of lozenges or pills, wax in form of electuaries, &c.

EMULSIONS.

The term emulsion is used to denote a liquid of milky appearance, prepared with oleaginous seeds and water.

All emulsive seeds contain, independent of the peculiar principles present in some of them, fixed oil, a little gum, a small proportion of saccharine matter and of acid, vegetable albumen, and vegetable caseïn, almost identical with the caseïn of milk. The vegetable albumen differs from the vegetable caseïn in this, that it coagulates by heat, and is not precipitated by acetic acid.

If we look at the composition of sweet almonds—that one of the emulsive seeds which serves most frequently for the preparation of emulsions—we are forced to admit, with M. Boullay, that the proportion of sugar and gum contained in them is too inconsiderable to permit us to attribute to their presence the division and suspension of the oil; and finding, on the other hand, abundance of vegetable albumen and caseïn in the sweet almond, we may assume as an unquestionable fact that the suspension of the oil is attributable to the presence of these two principles.

In some highly mucilaginous seeds, linseed for instance, the mucilage contributes, of course, vastly to effect the same result.

Oleaginous seeds intended for emulsion are, in the first place, freed from their skin. With almonds this is most readily accomplished; they need simply be kept a few instants in boiling water; this operation softens and loosens the skin, and a gentle rub between the fingers suffices to strip it off. The blanched almonds are then thrown into cold water, in order to harden them again, and finally wiped and dried.

The removal of the skin is absolutely necessary in the case of almonds, since their skin contains an adstringent principle which would impair the whiteness, and might, moreover, spoil the flavour of the emulsion.

The blanched and dried almonds are now pounded in a mortar, a little water being added to prevent the separation of the oil; if it is intended to prepare a sweetened emulsion, this is also the time to add the sugar. When the mass is thoroughly reduced to a fine paste, the requisite proportion of water is added and properly mixed with it; the emulsion is then finally strained through a bolting-cloth.

Acid or alcoholic liquors should, of course, never be added to emulsions, since they would inevitably coagulate them.

An emulsion separates some time after its preparation. The parenchyma of the almonds rises to the surface, together with a portion of the oil. At a later period the liquid enters into fermentation and turns acid from the formation of lactic acid; the coagulum increases by the continued separation of parenchyma and oil, and doubtlessly also by the progressive solidification of the caseine which is effected by the lactic acid produced by the fermentative process.

Egg yolk, mixed with water, forms a liquid perfectly analogous to the emulsions of the oleaginous seeds: in this emulsive liquid the oil is kept in suspension by the albumen.

We prepare sometimes spurious emulsions by mixing oils, resins, and gum-resins with water, with the aid of a mucilage or the yolk of an egg.

Artificial emulsions are frequently composed of gum, oil, and syrup. Several methods are resorted to for the preparation of artificial emulsions.

1. Prepare a mucilage with the gum and a sufficient amount of water, and add the oil gradually, stirring the liquid briskly all the while.

2. Mix the pounded gum and the oil in the mortar, and add the liquid gradually, with brisk stirring or beating.

3. Mix the powdered gum in the mortar alternately with the oil and the syrup, and add finally the rest of the liquid.

4. Beat up together in the mortar the gum, oil, and syrup.

These different processes succeed equally well, provided the several ingredients be used in properly-corresponding proportions. But the first

of them answers best where the quantity of oil is comparatively more considerable than that of the other ingredients.

Gum is not the only substance capable of emulsioning oils. As precedently stated, vegetable albumen produces the same effect in the emulsive seeds; the albumen of the latter will suffice even to emulsion a larger proportion of the oil than the seeds contain. Emulsion of sweet almonds, for instance, will bear an addition of oil; for this purpose, however, the oil must be added whilst the almonds are being pounded.

The white or the yolk of eggs are preferable to gum for the emulsioning of thick and viscous oils, such as castor-oil, for instance. In all other cases the use of gum is preferable, since emulsions made with egg yolk have a less agreeable flavour and colour.

As regards solid fats (wax, spermaceti, &c.), their emulsioning is restricted, of course, to comminution and mechanical suspension in the liquid. For this purpose the solid fat is to be triturated in conjunction with the sugar and the gum, and the finely-pounded mass subsequently mixed with the liquid. Or the fat is melted and mixed with the mucilage in a heated mortar, in which case the emulsion is perfect as long as it remains sufficiently hot to maintain the fat in the fluid state. But with the refrigeration of the mass the fat recovers its natural solidity, and all that we can expect to accomplish is to preserve it in a state of extreme division. The addition of a certain quantity of liquid oil will, of course, facilitate the operation, tending as it does to soften the solid fat. For the same reason it may be preferable to use egg yolk instead of gum in cases where the proportion of the solid fat is not too considerable.

SECTION I.

OILS, FATS, AND SUBSTANCES WHICH OWE THEIR PROPERTIES TO THE FATTY PRINCIPLES WHICH THEY CONTAIN.

Commerce supplies the apothecary with the following oils and fats:—

OLIVE-OIL.

This is extracted from the fruits of the olive-tree (Olea europæa); it is greenish yellow, and has a sweet and agreeable taste, and a feeble but peculiar odour. Its density is 0.92 at 77 Fahrenheit. At 35 or 36 Fahrenheit it commences to deposit a solid matter, which, according to Pelouze and Boudet, consists of a combination of margarine and oleïne. For the means of testing the purity of olive-oil I refer to a former lecture (on medicated oils).

POPPY-OIL.

This is extracted from the seeds of Papaver somniferum. It is of a light yellow colour, and has a mild nut-like taste. It is soluble in 25 parts of cold, and 6 parts of boiling, alcohol.

LINSEED-OIL.

This is extracted from the seeds of Linum usitatissimum. It is of a light yellow colour, and has a peculiar taste and smell. Its density is 0.93; it congeals at — 16.6 Fahrenheit. It is highly siccative; once transformed into varnish, it ceases to be soluble in alcohol, ether, and the oils. The siccative property of linseed-oil may be strengthened by boiling it with 1-16th to 1-20th part of litharge; this serves to remove the albuminous and mucilaginous matters which protect the oil from the action of the air.

NUT-OIL.

This is extracted from the fruits of the walnut-tree (Juglans regia). It is greenish, and has a feeble odour. It thickens at 5 Fahrenheit, and solidifies at — 16.6. It is more highly siccative than linseed-oil. We use the hot drawn oil of commerce in purgative clysters.

MUTTON SUET.

This is the fat accumulated round the kidneys and intestines of the sheep (Ovis aries). Mutton suet is a solid white substance of peculiar odour. It solidifies at 98.6 Fahrenheit. It contains 75 per cent. by weight of a stearine which solidifies at 93.2 Fahrenheit. The peculiar smell of mutton suet is owing to the presence of a peculiar principle, *hircine*, a species of oleïne which yields a fatty and volatile acid, termed hircic acid.

Sweet almonds and cacao owe their properties principally to the fatty matters which they contain. In our medicinal preparations we frequently associate with these fatty matters the principles which accompany them in the fruit, as the albuminous and caseous principles in the almond, the tannin in the cacao bean.

In nutmegs, laurel-berries, musk, castoreum, amber, a greater or smaller proportion of volatile oil is associated with the fatty principle; the latter may, in fact, be regarded here as simply accessory, yet its presence exercises a most marked influence upon the pharmaceutical treatment to which these several substances (nutmegs, &c.) are subjected.

Lastly, as regards the oils of the Euphorbiaceæ and cod-liver oil, the active principles intimately associated in these oils with the fatty substance impart to them a remarkable efficacy.

BEESWAX.

The bee, Apis mellifica, builds the cells of its hive with a peculiar principle, called wax. On melting these cells we obtain the common yellow wax, which fuses at 143.6 to 145.4 F. The yellow wax is bleached and changed to white wax, by exposing it in thin layers to moist air. White wax is less fusible than yellow wax; it fuses at about 149° F.

According to John's analysis wax is a compound of two different principles, denominated by him cerin and myricin. These two principles have been studied since by Boudet and Persoz.

Cerin forms at least seventy per cent. of the compound. It has about the same properties as the wax. It fuses at 143.6. It dissolves in boiling alcohol, and is readily soluble also in hot essence of turpentine. It saponifies with potass, the process being attended with formation of margaric acid, an exceedingly small quantity of oleïc acid, and a considerable amount of fatty non-saponifiable matter, ceraïn, which fuses only at 158° F.

Myricin is a white, insipid, and inodorous substance. It fuses at about 149° F. It is very sparingly soluble in alcohol; even boiling alcohol fails to dissolve it in a notable proportion. It refuses to saponify with the alkalis.

Wax constitutes one of the bases of a certain class of pharmaceutical preparations known under the denomination of cerates; it enters also into the composition of a great many ointments and plasters, and forms an ingredient of certain medicinal preparations used in dysentery, and some diseases of the intestines attended with excoriation.

EMULSION OF WAX.

Take of Gum arabic,
Yellow wax, of each 24 grammes.
Sugar-syrup, 192 grammes.
Water, 250 grammes.

Make a clear mucilage with the gum and fifty grammes of boiling water in a heated mortar. Fuse the wax, and add the fused mass to the mucilage; stir the mixture well, and add, finally, the sugar-syrup and the rest of the water, taking care to keep stirring all the while.

ELECTUARY OF WAX.

Take of Yellow wax,
Gum arabic,
Boiling water,
Raspberry-syrup, of each equal parts.

Make a mucilage with the gum and the boiling water in a heated mortar; add the melted wax, and finally the syrup.

CEROMEL.

Take of Honey, 2 parts.
Wax, 1 part.

Melt over a gentle fire, and mix.

Recommended by Dr. Aitken for the dressing of sanious ulcers, which it is desired to dry up.

PROPOLIS.

We call propolis the substance which the bees use to stop up the chinks in their hives.

M. Vauquelin found in this substance:—

Resin,
Wax,
Debris of vegetables and insects,
Gallic acid,
Benzoic acid.

Propolis intended for medicinal purposes requires a preliminary purification. For this purpose it is melted in conjunction with double its own weight of water, and the melted liquid subsequently strained with pressure. When the propolis has solidified, it is separated from the water and from the dregs that have subsided.

POMATUM OF PROPOLIS.

Take of Purified propolis, 1 part.
Olive oil, 1½ part.

Liquefy at a gentle heat.

The pomatum is used for hemorrhoïds, and also to dress old ulcers.

FOREIGN SCIENTIFIC INTELLIGENCE.

RESEARCHES ON MADDER-ROOT.

By Dr. H. DEBUS.

Schunck and Schiele have respectively lately given to the world the results of their inquiries on this subject. The author of the following paper began a series of experiments, under the direction of Professor Bunsen, at Marburg, in 1846. His conclusions differ in some respects from those of the above-named writers. The material operated upon was Zealand madder of the best quality. The roots were placed four times successively in boiling water of from fifteen to twenty times their weight until exhausted. The extracts were filtered through flannel. The liquids latest obtained were very faintly coloured. By boiling the liquids some time with hydrated oxide of lead in excess, one portion of the oxide is dissolved, while another, combining with the colouring principle, forms insoluble compounds of a reddish-brown tint. The liquid, meanwhile, has a pure yellow colour, and is not now precipitated by the salts of the heavy metallic oxides. The precipitated lead, after careful washing, is decomposed by heating with dilute sulphuric acid, by which the pigments combined with the oxide of lead are separated, and, in virtue of their very sparing solubility in water, they are easily separable from the acid by washing with water. The pigments are now repeatedly treated with boiling alcohol to exhaustion, and the insoluble residue consists of sulphate of lead combined with a dark brown matter. The experiments here described were conducted upon the substance taken up by the liquid and precipitated by calcined oxide of zinc. In order to obtain this substance the alcoholic solution must be agitated with small portions of oxide of zinc until the red colour disappears, and the oxide of zinc is removed by boiling the liquid for some time, after which operation the separation is easily accomplished. The zinc compound which was obtained was washed with spirit and warmed in contact with weak sulphuric acid, by which the pigments are separated, and the oxide of zinc then passes into solution. If heated repeatedly with ether after washing they are dissolved, with the exception of resinous substances, of a brown colour, and insoluble. The ethereal solution was precipitated with oxide of zinc, but an unctuous slightly-coloured substance remains suspended in the liquid. Sulphuric acid is again employed to decompose the compound, and the pigments after washing are several times exhausted with a strong boiling solution of alum until all deposit ceases. From the earlier solutions a reddish-brown substance separates, which in the later decoctions becomes yellow. To remove the alumina this coloured substance is boiled with dilute muriatic acid, and the insoluble matter is dissolved in boiling alcohol, from which it crystallizes slow on evaporation. This pigment is by successive re-

crystallization obtained in beautiful yellow-red needles several lines in length. The substance thus produced possesses acid properties and forms salts: the author calls it *lizarinic acid.** The solutions of alum from which this lizarinic acid has been obtained contain a dark red pigment, which, by the addition of sulphuric acid, may be thrown down, but is not completely separated in a shorter period than twenty-four hours. To get rid of the alumina yet contained in the precipitate, it is further exhausted with boiling dilute hydrochloric acid, washed with water, and dissolved by the aid of a moderate heat in from 150 to 200 times its weight of alcohol. In three or four hours the pigment separates from the solution, and forms red needles from two to three lines in length. This substance the author calls oxylizarinic acid.

Lizarinic acid dissolves very imperfectly in the boiling alum solution, and separates from it on cooling, but oxylizarinic acid dissolves in it speedily with a dark colour, and if the proper proportion of alum has been employed does not deposit anything even after long standing. Twenty pounds of madder gave from four to five grammes of the two acids. The above-mentioned substances form the only portion of the matters precipitated from the alcoholic solution which are soluble in ether. The insoluble residue consists of several resinous bodies which the author has not hitherto been able to separate. When this insoluble residue is boiled with alcohol a great portion of what is dissolved separates in brown flakes, and a farther separation may be effected by removing a part of the alcohol by distillation, and the substance first separated gave—

Carbon	64.89
Hydrogen	5.91
Oxygen	29.20

The second separation gave—

Carbon	65.32
Hydrogen	6.07
Oxygen	28.61

The aqueous extract of the madder-root was disencumbered of these substances by continued boiling with hydrated oxide of lead, when a yellow liquid remained which was evaporated to the consistence of a syrup mixed with spirit: an abundant grey precipitate was thrown down containing oxide of lead in chemical combination, and not soluble in water. Besides the pigment, which forms a large proportion of the precipitate, the latter contained an acid which throws down acetate of lead and its ammoniacal salt, and the salts of the alkaline earth, but the pigment in all these cases is inseparable, and has not been detached even by digestion with animal charcoal. The alcoholic liquid from which the lead salt separated contains sugar and also a yellow substance which the author could not obtain in a pure form. When a solution of this yellow substance is heated to the boiling point with muriatic acid the liquid takes a green colour, and a dark green mass separates in flocks which are insoluble in water and alcohol, redden when treated with potash, and are again turned green by acids. The analysis of this flocculent mass gave—

Carbon	63.94	63.67
Hydrogen	5.02	4.94
Oxygen	31.04	31.39

This substance, it should be observed, has not been obtained in a crystalline form, nor have combinations been produced with it. A large amount of gypsum was detected in a qualitative analysis of the aqueous extract from the root, which crystallized when the extract was reduced to a syrupy consistence, giving sulphate of potash, phosphate of lime, chloride of potassium, silicic acid, and alumina.

Lizarinic Acid crystallizes from alcohol in fine crimson needles, soluble in ether or alcohol, less readily in water, but sooner in hot than in cold, imperfectly soluble in a boiling solution of alum, from which it deposits on cooling. Strong sulphuric acid dissolves this acid with a very deep blood colour; on the addition of water the pigment again separates, apparently unchanged. The salts of lizarinic acid are red or violet, and, excepting those of potash, soda, and ammonia, they are insoluble in water and in alcohol. When exposed to heat, this acid melts and sublimes in reddish-yellow needles. It is not affected by dilute nitric acid or by chlorine: it is dissolved by a mixture of chromate of potash and sulphuric acid, and a certain change is effected which the author was unable for want of material to investigate.

Combustion with chromate of lead gave—

Carbon	68.95	68.98	68.98	30=68.70
Hydrogen	3.79	3.80	3.78	10= 3.81
Oxygen	27.26	27.22	27.20	9=27.50

Lizarinate of Lead.—When a solution of acetate of lead in alcohol is added to a solution of lizarinic acid in alcohol, which has been rendered slightly acid by acetic acid, care being taken that the former acid is in excess, an abundant, beautiful violet precipitate is formed, insoluble in water, and soluble in an excess of acetic acid and potash. Lizarinate of lead has been exposed to a temperature of 320° without alteration. The salt was dried for analysis at 248°, and gave—

Carbon	38.18	38.51	30=38.55
Hydrogen	1.97	1.98	8= 1.71
Oxygen	..	..	7=11.98
Oxide of lead	47.62	..	2=47.76

Oxylizarinic Acid is distinguished from lizarinic acid by its facile solubility in an alum solution; in cold water it dissolves very slowly, but readily in hot. Potash, ammonia, soda, ether, and alcohol, dissolve it easily. Its salts comport themselves like the lizarinates, which they closely resemble in external properties. Fuming sulphuric acid dissolves this acid, producing no alteration, nor does reaction take place upon the application of heat, even so far as the expulsion of anhydrous acid, and, on diluting the liquid with water, the oxylizarinic acid is separated unaltered; but when the temperature is raised to 390° sulphurous acid is given off, and the liquid turns black. The liquid was dried at 248°, and its analysis gave—

Carbon	66.23	66.38	66.59	15=66.67
Hydrogen	3.73	3.87	3.87	5= 3.70
Oxygen	30.04	29.75	29.45	5=29.63

Oxylizarinate of Lead.—The statements made respecting the preparation and properties of the lizarinate of lead may serve to qualify the oxylizarinate. Its analysis gave—

Carbon	37.90	38.02	15=37.88
Hydrogen	1.72	1.87	4= 1.68
Oxygen	..	..	4=13.48
Oxide of lead	46.62	..	1=46.96

On comparing the formula of lizarinic acid with that of the oxylizarinic acid, we find that one atom of lizarinic acid requires one atom of oxygen to supply the elements of oxylizarinic acid. The author was shut out from pursuit of experiments on this point by want of material.

A process originated by Roubiquet has lately been much in vogue in madder-dyeing, the object being to increase the amount of pigment obtainable. In this process the madder is macerated with concentrated sulphuric acid to destroy the woody fibre and other parts in which the pigment is supposed to be retained. To determine the correctness of this assumption madder was repeatedly exhausted with cold, and afterwards with hot, water, and, finally, with alcohol, till no more pigment was yielded. In this manner the roots were rendered almost colourless, and yielded pectine, but no pigment, to treatment with sulphuric acid, washing, and boiling with water. The usefulness of the sulphuric acid must be, it is plain, of a different kind from that above given. The explanation seems to be as follows:—When madder is exhausted with cold water, and the extract set aside for twenty-hours, or heated for some hours, an abundant brown precipitate falls down and the liquid becomes slightly acid: this precipitate contains the pigment described above; it is insoluble in water and in alcohol, unless it has been heated to boiling with sulphuric, hydrochloric, or acetic acid. Of course by treating the substance with acids the valuable pigments again are made soluble and separated.—*Annalen der Chemie und Pharmacie* for June, part 3.

PARIS ACADEMY OF SCIENCES—Nov. 6.

Ever since Daguerre promulgated to the scientific world the method of impressing a shadow on a metal plate the philosophers have devoted much consideration to the achievement of some plan to paint those shadows with the native tints of the objects represented.

M. E. Becquerel has at length, as our readers possibly are aware, achieved the task; but, alas! his pictures can be only viewed in the dark—exposed to sunshine, direct or diffused, the colours vanish, and white and black alone remain.

M. Becquerel presented his account of this interesting discovery to the Paris Academy of Sciences in February last, since which period he has made further discoveries. The subject of M. Becquerel's first successful experiment was the chloride of silver, produced by slightly acting on a plate of polished silver by means of chlorine.

Similar results have been obtained by M. Becquerel from sensitive surfaces, produced by immersing a plate of silvered copper in solutions of the chlorides of copper and iron, &c., and the hypochlorites of soda, lime, &c.; he has recently determined, however, that the best results are obtained by using the voltaic battery, the metallic plate being placed at the anode in water, acidulated with hydrochloric acid, in such a way that an evolution of nascent chlorine may take place on the plate's surface.

On a surface thus prepared not only are the simple or prismatic colours but also the compound ones impressed.

M. Becquerel has in vain attempted to abstract the chlorine of the subchloride on which the colour is imprinted without destroying the latter. Hitherto, however, without success. Until this be accomplished the colour cannot be permanent, for immediately the subchloride is exposed to the solar light decomposition ensues, and the colour disappears.

REVIEWS.

DR. TANNER ON POISONS.*

The subject of poisons being a most extensive one, it is evident that the aspirations of an author who sends forth a brochure of some sixty-three 18mo. pages must have been circumscribed within very narrow limits.

The author's object, as he states in his preface, was merely to refresh the practitioner's memory on a subject not very frequently brought under his notice, and to show at a glance the treatment to be adopted in each particular instance.

We doubt very much whether the author has not another intention *in petto*. Instead of writing a book for the advantage of the practitioner, we think it probable that his chief hopes of sale were in another direction. At all events his little code of memoranda bears very much the aspect of one of those waistcoat-pocket manuals which serve as *grinding-books* for the lazy or incompetent amongst medical students.

Whether this were or were not his object, we are sure that in this direction will be his main chance of a second edition.

Chapter I., devoted as it is to the definition and mode of action of poisons, might have been profitably omitted from a book which proposed only to furnish memoranda for their practical treatment. The philosophy of toxicology is far too recondite a matter to be discussed with any profit save (to a Hall examinee)

* Identical in composition and properties with the *alizarine* of Schunck.

* Memoranda on Poisons. By T. H. Tanner, M.D., late House Physician to King's College Hospital.

in three tiny 18mo. pages. Chapter II., on the diagnosis of poisoning, is a strictly practical matter, and might profitably have been extended so as to occupy the useless space of the previous chapter. So far, however, as it goes, we have a fair condensation of Christison:—

"The chief characteristics of poisoning mentioned by Christison and other authors are, that the symptoms commence suddenly, after taking any substance or fluid into the stomach, the individual being in a state of health; that they increase steadily, and are uniform in their nature throughout their course; and that they prove rapidly fatal.

"When poison is administered with a criminal intent, it is, generally, in such a dose as to take immediate effect; although this is by no means necessary, as there are many substances which accumulate in the system, and, when given in small and repeated quantities, ultimately prove fatal. It must also be remembered that there are many diseases, as malignant cholera, &c., which commence suddenly, and rapidly run to a fatal termination. So, also, in organic disease of the heart, which may have remained latent for some time, death often occurs, suddenly, from syncope. The diagnosis of the effects of irritant poisons is not so difficult as it is in the case of narcotics, where the symptoms are very similar to those produced by apoplexy, epilepsy, and disease of the brain.

"Generally speaking, a person may be supposed to be poisoned if, after taking food or drink, he be seized with violent pain, vomiting, disorder of the alimentary canal, and convulsive movements: or if he be attacked under the same circumstances with vertigo, delirium, or great drowsiness. Should death ensue, the presumption will, of course, be strengthened by the discovery of *post-mortem* appearances, similar to those known to be produced by the poison from which the person apparently suffered.

"The *post-mortem* appearances, however, except in a few instances, are by no means to be relied upon, and the two symptoms, excessive lividity of the body, and early putrefaction, formerly supposed to indicate death by poison, are now known to be as frequently produced by natural disease. It may, however, be generally remarked, that the appearances after death which may be produced by poisons are, in one great class, the signs of inflammation of the alimentary canal; in another, the signs of congestion of the brain; and in a third, a combination of the two."

Chapter III., which is devoted to the chemical treatment of poisons in general, contains a good practical abstract of the philosophy of the subject. Judging from the author's arrangement in this portion of his manual, we should pronounce his toxicological knowledge to be well marshalled, and at command, such that, had he tried, might have enabled him to send forth a book of larger pretensions than the one before us:—

"In the treatment of a case of poisoning, the object of the physician may be comprised under three heads, namely,—

"1st. To promote the discharge of the poison from the system;

"2d. To counteract its operation by means of antidotes; and

"3d. To remedy the effects produced, and obviate the tendency to death.

"1st. To PROMOTE THE DISCHARGE OF THE POISON FROM THE SYSTEM.

"*a. When taken into the stomach.* This may be fulfilled in two ways, either by the stomach-pump or by emetics. The former is one of the most certain means we possess of emptying the stomach, and by means of it this viscus is washed out, and the antidote—if any be known—administered. In speaking hereafter, however, of the treatment to be adopted in each particular instance, it will be seen that there are some cases (poisoning by the corrosives) in which this instrument cannot be used, as it might not only cause laceration of the tissues, but even perforation of the œsophagus or stomach. It is hardly necessary to mention that in all cases a certain tact is required in its employment, the tube having, on more than one occasion, been introduced into the trachea. Supposing, however, that this instrument is not at hand, or that it is an improper occasion for its use, recourse must be had to emetics (unless the poison itself has produced sufficient vomiting), and perhaps there is not one which can be generally used with so much advantage as the sulphate of zinc in scruple doses, for not only is it more rapid in its action but its effects are less depressing than any others. This last recommendation will appear the more desirable, when we remember that the absorption of poisons is promoted by all lowering measures, and, consequently, bleeding, the administration of tartarized antimony, and similar remedies, should be avoided. In poisoning by opium and other narcotics, the sulphate of copper, in eight-grain doses, will often excite the stomach to act when other emetics have failed. In the absence of these, mustard proves an excellent substitute, a teaspoonful or two being given in warm water frequently repeated. Vomiting should also be excited by tickling the fauces.

"*b. When applied locally.* To prevent the absorption of the poison in these instances, a ligature must be applied between the trunk and wounded part, as near the latter as possible; and the deleterious substance removed, by exhausting the air over the part by cupping-glasses, &c.

"2d. To COUNTERACT THE OPERATION OF THE POISON BY ANTIDOTES.

"As no universal antidote is known, the treatment will, of course, vary with the substance taken, as will be fully explained when speaking of each particular poison.

"An antidote, according to Orfila, should possess the following properties:—It should be taken in a large dose without danger; it should act upon the poison, whether liquid or solid, at a temperature equal to, or below, that of the body; its action should be quick; it should be capable of combining with the poison, though shielded by the gastric juice, mucus, bile, or other substances contained in the stomach; and, lastly, it should deprive the poison of its deleterious properties.

"Antidotes operate by forming harmless chemical combinations, or by producing insoluble combinations, and thus preventing or delaying absorption. It must be remembered that they have no effect upon the constitution, and that their efficacy will, therefore, depend upon their being used early."

The author, proceeding in the development of his subject, soon arrives at a period at which he discusses the agency of chemical tests and reagents. Now, our opinion on this matter is strong, and, we believe, not singular. It is this, that if the practitioner of medicine have not acquired in the days of his youth such an amount of chemical knowledge as shall enable him to perform a toxicological analysis without referring to such meagre inanities as, under any author, the disjointed fragment of a little 18mo. volume, chiefly devoted to other considerations, must be, he had better delegate the task of analysis to other hands whose more specific duty it is.

We are always at a loss to understand why it is that with some persons toxicological chemistry is thought to be such an easy matter. To our mind there does not exist in the whole chemical field a problem more difficult of solution, nor requiring more ready acumen of research, than the discovery of a poison, often in minute quantity, admixed with complex organic matters. The separation of these complex matters is the main difficulty, whereas it is the fashion with a certain class of authors to ignore it altogether.

Let us consider, for instance, Dr. Tanner's remark on tests for sulphuric acid, and ask ourselves in what respect they would avail a medical practitioner suddenly called upon, possibly in the night, fresh from his dreams, to treat a case of poisoning by this material. We say they would avail him nothing. What would they avail him in a subsequent analysis? Less than nothing, we affirm; they would be actually a negative quality. Is a practitioner well versed in chemistry to testify for life or for death before a criminal jury on so meagre an amount of chemical knowledge that the remarks which follow shall be a refresher?—

"*Tests.*—The concentrated acid is an oily-looking liquid, which chars or corrodes wood or other organic matter brought into contact with it, and when mixed with water gives out heat. When diluted, its presence may be thus detected:—The liquid is known to be acid by its action on litmus paper; add to a portion of it a few drops of nitric acid, and then a solution of nitrate of barytes,—a white precipitate (sulphate of barytes) will fall if sulphuric acid be present. This test is extremely delicate, for although other acids yield a precipitate on the addition of nitrate of barytes, yet, as such deposits are all soluble in nitric acid, the previous addition of this acid will prevent their formation."

Far better would it have been if the author, writing professedly for the practitioner, had confined his remarks to such practical suggestions as these.

Being once assured by testimony or otherwise that poison has been taken, lose no time in ascertaining to what class the poison belongs, whether irritant, acrid, or narcotic, for which the general physiognomy of the case, so to speak, is usually sufficient.

That kind of acumen usually denominated common sense will throw at this period still further light on the subject, and afford a much readier solution of the question—what the poison is and what is to be given—than any strict adherence to chemical rule.

We will suppose the poison taken to be an irritant. The symptoms are generally sufficient to assure one of this. Well, do not immediately break the chain of the reasoning process, nor give any such universal antidotes as soap and water, white of eggs, or milk. Carry on the reasoning process a few moments longer—the time will be well employed. What are the probabilities between murder and self-destruction? A large portion of irritant poisons which possess a pungent taste and irritating smell could not have been given unknown; they belong to the suicide or have been taken suddenly by mistake. Under this head may be enumerated all the mineral poisons—a most important division—and also oxalic acid and bichloride of mercury, the former sometimes taken by mistake for Epsom salts. Have the symptoms supervened on a meal? Yes. Then the mineral acids and oxalic acid are out of the question; bichloride of mercury, too, may be almost discarded; and arsenic so strongly suspected that a definite treatment should be at once pursued. Have the symptoms supervened on a meal? No. Self-destruction is suspected. What is the agent or, at least, to what practical division does it belong? But stay; on the mantelpiece is a cup; beside it is a phial; the contents are all but gone; but the sides are moist; the liquid tastes acid; this is enough. The practitioner does not stop to ascertain what the acid may be; it matters not, the treatment being the same; he sends to the kitchen; orders a copious paste of whiting and milk to be made *instanter;* meantime he turns to his patient. The patient's lips are white, with dark specks; his black coat is coloured red in spots; he writhes in agony, but he loses none of his mental faculties (indicative of some mineral acid). Meantime the antidote arrives, and the patient is made to drink of it in copious doses. The practitioner may now pause for an instant, with the satisfaction that up to the present time no more could have been done.

Such are the practical indications alone which should, in our opinion, be given in a treatise really intended to be useful to the medical attendant suddenly called upon to treat of poisoning. Doubtless, in the spirit indicated, a book the size of Dr. Tanner's might be made essentially useful to the practitioner; in its present form it will be, we repeat, more adapted to

the *grinding student;* and, by obviating the necessity of mastering the science of toxicology for the purposes of a pass examination, may be productive of a considerable amount of harm.

Treating on the tests for arsenic, Dr. Tanner proves that his chemistry is not of the laboratory, by committing a most capital blunder in the important matter of testing for arsenious acid:—

"*The gaseous test* (he writes) consists in passing a stream of sulphuretted hydrogen gas through the solution, previously acidified by some acid (as the acetic), when a yellow precipitate will be produced. If this precipitate be collected and dried, and the reduction test applied (black flax being used instead of charcoal), a ring of metallic arsenic will be produced."

The author, in using the expression "by *some* acid (as the acetic)," clearly indicates that the kind of acid is by no means an important matter, whereas all practical chemists are well aware of the contrary. Indeed, the neutralization—accurate neutralization—of all unknown acids, and substitution of acetic acid in their place, is amongst one of the most essential procedures antecedent to the transmission of a current of gas.

The paragraph on treatment of arsenical poisoning is very good:—

"*Treatment.*—The first object must be to expel the poison from the stomach, for which purpose the stomach-pump may be advantageously employed, or emetics of sulphate of zinc or mustard administered, accompanied with albuminous or mucilaginous diluents to promote vomiting. Mr. Taylor advises equal parts of oil and lime-water to be given, the oil investing the poison, and the lime rendering it less soluble. Charcoal, magnesia, &c., when taken in large quantities, may be of service by enveloping the arsenic, and preventing its contact with the mucous membrane of the stomach; but oil or milk will act more efficiently in this manner. The hydrated sesquioxide of iron, at one time much lauded as an antidote to arsenic, has more recently been thought almost useless by Orfila, Taylor, and other authorities. It would appear from their experiments that the cases reported as successfully treated by this substance were evidences of *post hoc*, therefore *propter hoc*, reasoning. If, however, it is tried, it must be administered moist, and in large doses, as a table-spoonful frequently repeated, after the stomach-pump, &c., has been used.

"The subsequent treatment must be conducted on general principles, according to the severity of the symptoms, but the great depression of the vascular system must not be overlooked in combating any inflammatory action. Opiates will be found of great service."

Treating of the bichloride of mercury, Dr. Tanner also states, properly enough, what is to be given; but his rationale of the action of albumen on bichloride of mercury is chemically incorrect:—

"This must consist in the removal of the poison and the administration of antidotes. Vomiting is best promoted by administering copious draughts of fluids containing the latter: but, if necessary, an emetic may subsequently be given. Various antidotes have been recommended for this poison, among which albumen and gluten of wheat are the most to be relied upon: the former acts by combining with the bichloride, and partially converting it into calomel. The whites and the yolk of raw eggs should, therefore, be abundantly given: for although one egg has been thought sufficient to render four grains of the poison innocuous, yet no injury can result from giving too many, as they will promote vomiting. Gluten has been much recommended, and may readily be prepared by washing flour in a muslin bag, under a stream of water: on an emergency, however, it will be best to exhibit the flour at once made into a paste with water. Several other antidotes have also been proposed, as iron filings, gold-dust and iron filings diffused in mucilage, protochloride of tin, and hydrated protosulphuret of iron; but, in the present state of our knowledge, it will be advisable to employ those substances only with whose action we are fully acquainted."

Now, we did imagine that every chemist in these days was aware of the circumstance that Lassaigne long ago, we believe in 1837, proved that bichloride of mercury was in reality not converted into calomel by the agency of albumen, but that it formed with the latter an insoluble combination.

We need not pursue our critique further. The reader will have gathered our general opinion of the brochure, and the author will, we trust, be assured that we have met him in no unfriendly spirit.

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 25, 1848.

AN UNIVERSITY FOR THE MANUFACTURING CLASSES.

A REPORT of the annual *soirée* of the Manchester Athenæum will be found in another part of our pages, accompanied by some passing remarks of our own.

Amongst the addresses which were delivered before that Manchester audience, the poetical rhapsody of Lord Mahon shines prominently forth, and almost eclipses the less florid effusions of his worthy colleagues for that night. His lordship has not a more warm admirer than ourselves of his refined taste, his popular tendencies, his noble aspirations; neither do we yield in any to the measure of respect for the genius that so long has been an heirloom of the race from which he springs.

None could have better than his lordship enlisted the sympathies of those whom he addressed — none could have more gracefully culled from the broad domains of literature and science the flowers that presented themselves to his view. The sterner task of delving for hidden gems, enveloped in the dark recesses of the philosophic earth—of penetrating to its ocean depths for pearls existing but unseen,—these were duties that his lordship professed himself incompetent to achieve, and devolved them to abler hands. His lordship's poetical rhapsody on science and its attributes reminds one of a phantasmagorie sketch, or dissolving view—beautiful though fleeting,—truthful yet unreal. As dreams crowd upon a slumberer, or images rapidly pass before a fevered brain, so did Lord Mahon, in his eloquent address, depict enough of the scientific world in hazy beauty to clothe the whole in poetic mystery, but to afford a lucid view of no one part. Whilst we ponder over his lordship's address and admire the rounded beauty of his periods, and the rapid flow of imagery with which those periods are marshalled in, we feel that something is hidden—is lagging behind. We feel the want of some practical suggestion by which the aspiring youths of Manchester shall arrive at their literary and scientific goal.

Mr. Bright soon followed in his discourse, and perfects what his lordship had just commenced. We shall not accuse the sturdy advocate of free trade of having too much poetry in his soul—indeed, some may be of opinion that the error is the other way. Certain, however, it is that, having stood up, and expatiated fully and forcibly on the responsibility of a proper employment of time, he practically, and in few words, gave force and body to the aspirations which his lordship had just evolved.

That science and literature were good and desirable things we had just been told,—how to obtain them generally was not so clear, until Mr. Bright, in commenting on the improprieties of education for the manufacturing classes, advocated the establishment of an university for their interests.

Now, this proposal of establishing an university for the manufacturing classes is, in our opinion, one whose practical value must be obvious to all thinking people, inasmuch as at the present time our existing universities are clearly incompetent to impart that kind of information which is mainly useful to the classes whose interests are represented by the Manchester Athenæum.

The alterations which have been effected in the curriculum of study at Cambridge are good so far as they go; but even now, that institution is by no means adapted to fill the recognised void in national education. Even were its curriculum of study most unexceptionable, still its locality alone would be a serious impediment to the imparting of education to the manufacturing classes. Still more foreign to this end is the University of Oxford, the classical exclusiveness of which holds its pristine sway; and, turning to the University of London, we find that it is not an university in the ordinary sense of the term, but merely an examining board.

It is more easy to rectify any other abuse than the abuse of prestige. The curricula of Oxford and Cambridge might be altered to-morrow—brought up to suit the genius of the present age, and expurgated from all mediæval inanities—still their prestige would, in the present state of society, for a considerable time remain. Lord Brougham has more than once correctly indicated the reason why a large section of the commercial and other middle classes send their sons to Oxford and Cambridge—not to buy in a store of education for after life, but to make aristocratic acquaintances and form aristocratic connections.

Thanks to the reviving intellect of the nineteenth century, this feeling is rapidly dying away. The theory of useful education commences to be viewed in a true light for itself. What, then, should be the kind of education most profitable to the manufacturing classes? Is it a study of the dead languages, or Aristotelian philosophy, or abstract mathematics? We are now judging of things, not for their prestige, but for what they are intrinsically worth. We say, then, that to the manufacturing classes the knowledge of Greek and Latin is, and long has been, a mere badge of clique—a passport to gentility, conferring no real power whatever, and, imperfectly learned as these languages usually are, productive of no real pleasure; whilst a study of the living languages, of general science, and of international policy would minister directly to the wants of this large, and powerful class.

Let us not be misunderstood we beg to say again,—and taken for utilitarians of that hard and rigid stamp who would chase each vision

of the unreal world from the jaded intellect of man, and banish poetry from the earth,—who would proscribe the hallowed languages of classie Greeee and Rome for no better reasons than the ones that their sounds are mute, and the classic authors translated. They will be the elegant study and the solaee, the recreation, of many a polished mind hercafter as of yore. But, if the primary objeet of edueation be to supply essentials and not elegancies, the study of the dead languages has long ceased to be a paramount object to the manufaeturing classes, and the same assuredly may be pronounced of Aristotelian philosophy and the abstract mathematics.

ON THE PREVENTION OF POISONING.

In reference to a late aeeidental case of poisoning, wherein strychnine was unfortunately mistaken for salicine, a eorrespondent of the *Times* suggests that all poisonous substances, if kept by druggists at all, should at least be preserved in eupboards apart from ordinary and harmless compounds. The plan to one unaequainted with medicine is simple and specious; but how utterly impossible can only be known by considering that a large moiety of ordinary medicinal agents belong to the proscribed eategory, and few prescriptions could be dispensed without unlocking the doors of this eupboard of death. Even the most aeeurate classifier of medieinal agents would fail to effect a good practical distinetion between poisonous and non-poisonous agents. One by one each compound would be eonsidered proper to be locked away in the poison cupboard until the materials of the druggist's shop would be arranged under two equal divisions, and the original object of safety entirely lost.

Better, far better, than any preeaution of mere arrangement will it be to faeiliiate the aequirement of knowledge by the rising class of druggists' assistants. Whilst the world reeognises the safety of a careful physieian preseribing a poison, surely it is not preposterous to assume that a careful, well-educated druggist may be trusted to dispense the same without imposing on him any such a trivial (were it possible) restraint as the oft-reeurring loeking and unlocking of a eupboard or a box.

THE MANCHESTER ATHENÆUM.

It is not more highly ereditable to the refined taste of the inhabitants of Manchester than indicative of a great social development amongst the manufaeturing classes that the Manchester Athenæum gathers new power and vitality with every passing year.

On the evening of the 16th inst. was held the annual *soirée* of that institution in the Townhall. Lord Viseount Mahon in the ehair.

The room was erowded with a general audience, and on the platform were the mayor, Mr. Philips; the late mayor, Mr. Brown, M.P.; Mr. T. M. Gibson, M.P.; Mr. Bright, M.P.; Mr. Crossley; Mr. Brotherton, M.P.

The noble Chairman proceeded to address the assemblage as follows:—Ladies and gentlemen, appearing before you, as I do this evening, altogether uneonneeted with you by residence or representation—a stranger personally to almost every one around me, and differing from many amongst you in views and opinions on publie affairs—I yet believe that these very eireumstances afford only a elearer token, a more convineing proof, of that link of brotherhood which should always bind together those engaged in the pursuits of arts and letters or of science—(Cheers). When you invited me to my present high position, and when I accepted the honour proposed to me, you felt, and I felt, that men animated by the same desire for mental cultivation should not be deemed strangers to one another, and that party differences should be laid aside for the time, frankly and freely, whenever the question arises by what means knowledge may be best appreeiated and most successfully diffused—(Cheers). I think I may say that meetings like the present, besides their first main object, are also in their collateral effeets highly benefieial. To whatever opinions or denominations we belong, we are all, I fear, inclined to judge too little favourably of each other. Surely, then, it is no slight advantage of an assemblage like this—inviting to one eommon field of action labourers both far and near—that we shall depart with kindlier feelings, with a belief in eaeh other's rectitude of purpose to our different paths, and with sentiments of increased personal friendship and good will—(Cheers). The institution whose anniversary we are met to eelebrate has for its object to diffuse as widely as possible the advantages derived from the study of literature and seienee. In both these departments the objeet is to render the library and the other means of information as ample and as well seleeted as they can be. Now, first, as to seienee, I eannot but feel it almost superfluous that I should say a single word to reeommend its study to such a meeting as I see before me. For, if you look around you, if you see the greatness and importance whieh Manchester has attained, and if you consider within how limited a period that attainment has been achieved, you cannot, I am sure, forget that this greatness and this importance are mainly owing to the discoveries of modern science—(Cheers). Consider what rapid advances these discoveries in seience have enabled you to make. Little more than a eentury ago the young Pretender marehed through your town and lodged at a house standing not many years since in Market-street. I ask you, if it were possible for him to revisit these seenes, do you think he would reeognise them again? Do you think he would see any resemblance between the not considerable eountry town, as this then was, which he so easily marehed through, and what it has now beeome—this immense eapital of our manufaeturing enterprise, this vast mart of aetive wealth, this swarming hive of busy industry?—(Cheers.) What would he have said to those lines of factories which have arisen on every side, affording honourable employment to hundreds of thousands of our people, and the beneficial effects of whose produce have been felt in the remotest eorners of the globe?—(Cheers.) When I see, then, so much progress made, and know that this progress is due to science—when the diseoveries of science form, in faet, the chronicles and annals of your eity—can I doubt for a moment that the study of seience requires no words of mine to call forth encouragement from you—that you will all be desirous to explore the root of your own greatness, the groundwork of your own importance?—(Cheers.) In no plaec, therefore, do I think that recommendations to the study of science can be less required than in the city where I have now the honour of addressing you—(Cheers). Nor let me be told that the study of seienee is too hard and difficult for hours of leisure—for hours that must be taken from many other aetive pursuits. Let me remind those ladies who have graced and honoured us with their presence this evening that one of themselves—one of the ladies of England, Mrs. Somerville—(cheers)—is not more remarkable for the depth and accuracy of her own seientifie knowledge than for the still higher and rarer gift of making the avenues to that knowledge clear and delightful to others—(Cheers). There is another writer of the present day—Professor Nichol, of Glasgow—who deserves the same praise, that, while his own seientific attainments are deservedly held in high estimation, he has written popular works which make the first elements of science easy of acquirement and within the reach of all. I do not mean, of eourse, that in science, more than in any other pursuit, high skill and proficiency can be attained without severe labour and exertion. I am speaking only of the first rudiments, the earliest stages, of science. Indeed, my own aequirements would not qualify me at all to speak of other than these; but, speaking so restrietedly of the mere elements of science, I can assert from my own experienee that their study is not ineompatible with other pursuits, and that it may be the souree, even when pursued no further, of high intellectual pleasure—(Cheers). When I alluded to seienee as having peculiar claims to encouragement at Manchester, I referred, of eourse, to the progress of meehanics, or more praetical science. But there are other branches of whieh it is the boast and pride that they are confined to no one age, to no one clime, to no one country, but may receive pursuit and eneouragement in all. The names of Mrs. Somerville and Professor Nichol which I have ventured to mention naturally suggest to me the seienee in which they have attained sueh eminenee—the study of astronomy. Now, even the first elements of astronomy are eapable of affording intelleetual pleasure of no ordinary kind. I remember that an English statesman of bygone years—one certainly not to be approved for many parts of his publie life, and still less to be esteemed or exeused for what he termed his philosophical opinions, but still a man of great and surpassing genius—I mean Lord Bolingbroke—goes so far as to enumerate among the eonsolations of exile that there is no spot on earth where the study of astronomy may not be pursued. His words on the subject are marked by so mueh eloquence that I am sure you will forgive me if I attempt to repeat them. Lord Bolingbroke says, in his "Refleetions on Exile," "There is no part of the world whence we may not admire those planets that roll like ours in different orbits round the same central sun—whence we may not gaze on another object still more stupendous, that array of fixed stars hung up in the vast space of the universe, innumerable suns whose beams enlighten and eherish the unknown worlds whieh revolve around them; and while I am wrapt in contemplations sueh as these, while my soul is thus borne up to heaven, it imports me little what ground I tread upon." Such are the words of Lord Bolingbroke. But, in speaking of the praise that belongs to the study of astronomy, testimonies much higher as well as mueh more ancient than this might be adduced. There is, I have always thought it, a most noble and striking thought of Cicero in the first of those unrivalled essays on philosophy which he wrote in his villa of Tusculum, and whieh thenee derived their name, wherein he says that, in his opinion, the man who is able by the force of his intellect to calculate the movements of the great eelestial bodies, and to decide in what orbits they are about to run, shows that his mind is akin in its immortal nature to that Almighty Being by whom these celestial bodies were fashioned and formed. Surely, that is a striking thought from a heathen writer on whom the light of revelation had never shone. But we who know in the words of unerring truth that God created man in his own image, we can to such a thought as this affix a higher and a holier meaning. Sure I am, at least, that in no one pursuit does man elevate himself more above his frail being here below, and manifest more clearly the immortal spark within him, than in those studies of astronomy which enable him, an atom as it were in creation, living in a world, after all, but another atom in ereation, to calculate with unerring preeision the precise second of time when one of these celestial bodies will appear to eclipse another in the sky, or tell the precise instant of time when one of the great fixed stars shall appear to shoot aeross the dise of his telescope—(Cheers).

Are not those achievements of the human mind worthy of praise, worthy of celebration, worthy of attainment?—(Cheers.) Sure I am, too, that no one study, if properly pursued, is better adapted to raise up our minds in humble adoration to the Almighty Being who has made us what we are, and has permitted us, though at an infinite distance, to prosecute with so much advantage the discovery and knowledge of his wonderful works—(Cheers). There are other branches of science which, unlike astronomy, have not flourished in many ages and countries, but which, on the contrary, are remarkable for the great and rapid strides which they have made in our own days. Not, indeed, that astronomy has not made great progress too, but there are sciences which have, as it were, started into being altogether within the memory of man. Such a science is geology. See what great triumphs of geological discovery have been achieved, and within how narrow a space of time! We cannot, perhaps, measure this progress more clearly than by marking the altered feelings with which men of education and knowledge speak of geology. In the last century it was not an unfrequent topic of ridicule; now we find its discoveries treated with general respect and esteem. Sixty years ago, for example, Bishop Watson, a man of no mean order of mind, of no inconsiderable intellectual attainments, used to say that the geologist who attempted to speculate on the internal formation of the globe reminded him only of the gnat, which, perched on the shoulder of an elephant, would, by the reach of its tiny puncture, presume to tell the internal structure of the majestic animal below. These were the words of Bishop Watson. Would any man of common education or judgment use similar language now? Is there any one who would mention but in terms of respect and esteem the researches of such men, for instance, as Dean Buckland and of Sir Charles Lyell? See, too, what great and curious results have crowned those researches. Take the very point of the internal structure of the globe, on which it was thought that nothing beyond the reach of actual observation could ever be probably conjectured. I need not remind many among you how, when layers of matter, strata as they are called, decline into the earth at a certain angle, and then at a vast interval of space reappear at a similar angle, and at exactly similar distances between similar layers, it has been found possible to calculate, with a possibility approaching to certainty, what would be the structure of the globe miles and miles lower than the foot of the most adventurous miner ever trod—(Cheers). Of course I can glance only briefly at such a topic; but if it were developed by those better able by scientific attainments to do it justice you would see that even on that ground on which the deriders of geology meant to rely it presented the scene of one of our intellectual triumphs—(Cheers). In speaking of geology I would not disjoin from it that science which, strictly speaking, is not identical, but yet is seldom separated from it in study—I mean that in which Cuvier attained such mastery and skill, the study of the remains of extinct races of animals and the reconstruction of their scattered bones, so as to afford by analogy no small probability as to their original structure, their size, and even their habits of life. Surely this, again, is a great triumph of the human mind—(Cheers). Surely, then, even in its elements, even in its first stages, this science is well worthy your hours of leisure—(Cheers). I remember being especially struck with one of the discoveries of Cuvier relating to one of those animals which, as far as we know, human eye had never seen; and of which, in this instance, so far as we know, no vestige of its substance, no fragment of its bones, nor one shred of its skin, remains. Well, then, if this animal had never been seen or recorded in the annals of man, if no fragment of its substance remains, just ask yourselves, for a moment, how was it possible to acquire any knowledge respecting it? Does not this at first sight appear an almost impossible task? Yet the difficulty was overcome by Cuvier. And how? By the footsteps which the animal in its lifetime had imprinted on the seashore. Those footprints had become petrified in the course of years, and from the examination of them Cuvier had been able to deduce, from the interval between the footsteps, a calculation as to the size of the animal, and, from their configuration, a calculation as to the order to which it belonged by comparison with other animals; and thus, with no other vestige remaining than these petrified footsteps on the shore, he has been able to construct, not as a vague theory or guess unsupported by experience, but as the result of analytical and analogical reasoning, a most probable system as to the size, structure, nay, even the habits of this animal—(Loud cheers). Am I, then, wrong in saying that the science which presents such results, which even when imperfectly studied seems so surprising, is one that may be well recommended to you, and in which you cannot fail to find abundant sources of delight?—(Cheers.) From the study of science turn; for a moment, to the study of literature. I think I may say that literature also will afford for your hours of leisure objects well worthy of attentive pursuit. For instance, in the field of historical literature how many subjects of interest present themselves to you. Perhaps in the whole range of historical literature there is none more fraught with interest and full of instruction, in every way more worthy your attention, than the study of that city whence the name of your institution is derived—the study of the history of Athens—(Cheers). It has been the lot of few amongst us to be able to explore for themselves the remains of that renowned city; yet who is there that has cared or thought for literature who has neglected to explore its story? Who is there that has not sought to familiarize his mind with its scenes—to trace the remains of that majestic temple which crowns the Acropolis, and which even in its present state, despoiled as it has been by man, scathed as it has been by time, is yet, perhaps, superior to any other structure in the zenith of its splendour and fresh from the sculptor's hands? Who is there that does not love to trace in description, and to see, as it were, with his mind's eye, the prospect which presents itself from the citadel and temple of ancient Athens, those marble columns still standing around the sunny heights of Hymettus, that plain divided by a scanty stream, and grey with its scattered groves of olives, and beyond in the distance the azure expanse of the Ægean Sea?—(Cheers.) You will remember how the scene from that spot has been described by a great poet of the present day:—

> "As thus within the walls of Pallas' fane
> I marked the wonders of the land and main,
> Alone and friendless on the magic shore,
> Whose arts and arms but live in poets' lore,
> Oft has the matchless dome I turn'd to view,
> Sacred to gods, but not secure from man,
> The past return'd, the present seem'd to cease,
> And glory knew no clime beyond her Greece."

(Cheers.) And then you will remember that in another passage on the same subject Lord Byron adds:—

> "Who that beheld that sun upon thee set,
> Fair Athens, could thy evening face forget?
> Not he whose heart nor time nor distance frees,
> Spellbound within the clustering Cyclades."

(Cheers.) It is natural that this scene should become familiar to the minds of all of us, for it has been the birthplace of some of the noblest writings, of the noblest works of art, of the noblest speculations in philosophy the world has yet seen—(Cheers). In branches of science and many other departments of human knowledge we have outrun the early Athenians, but in some we have never yet been able to surpass or even rival that great people, who, like its own emblem of Minerva, sprang full-grown and full-armed into life—(cheers)—and at an early period of its history produced works which even the ripest maturity of genius and civilization has never yet been able to exceed—(Cheers). Great as are the strides we have made in other points, the world has yet to seek a sculptor greater than Phidias, an orator greater than Demosthenes, a philosopher greater than Plato—(Cheers). And allow me to remind you that in one respect the study of Athenian history, which many popular modern works render delightful and easy of attainment, comes, I think, peculiarly home to you. In ancient Athens the study of the arts and the acquirements of literature were united with and made to flourish by the pursuits of commerce—(loud cheers)—for, while those great speculations in philosophy were being pursued in the groves of the academy—while Phidias was raising the masterpieces of his art—at that very time ships of every clime then known were crowding the wealthy port of the Piræus—(Cheers). Thus it was that, amongst that people, the pursuits of commerce were not only joined with, but formed the foundation of, a superstructure of art and literature, which continues to excite our admiration still. Surely this is no uninteresting study to pursue; surely this is no unworthy model to follow—(Cheers). You will, I am sure, continue to remember what we are taught by the history of Athens, that the wealth which has been honourably gained in the pursuits of industry can, in few ways, be more gracefully and liberally dispensed than by enriching our native city with works of art, and our native tongue with contributions of literature or science—(Loud cheers). In this respect allow me to repeat my opinion, that Athens is a model which may be held out with advantage to all, and which every one may at least study with the greatest interest and pleasure. There are few, I imagine, who would doubt that studies of this kind, when fully pursued, must be a great source of improvement and of pleasure; but I should wish to convince you of a fact, not less certain though less commonly acknowledged, that an acquaintance with the scenes of history may advantageously mingle with many details of our common life, may lend fresh zest to every pleasure, and enable those who possess it to have enjoyments which others cannot know. Let me take the trivial occurrence of a summer's holiday; let me suppose the time when many among you, released for a time from your active occupations, are able to enjoy a few days' excursion, and let us see whether this same knowledge of history may not add greatly to the pleasures you may derive from it. I will suppose that the traveller whom I am representing might pass rapidly, with all the speed which railways now supply, through the fens of Lancashire, already familiar to him, and stopped short when he arrived at Penrith or Carlisle. I suppose that thence he might be anxious during his leisure to explore the lakes of Cumberland on the one side, or to range beyond the Cheviots on the other. If he turn to the left and wend his way to the lakes of Cumberland, when he ascends the last hill above the lake of Derwentwater, and sees the fair prospect opened before him, he will on the summit of the hill find himself in the circle of Druidical stones. To one who has not attained a knowledge of the details respecting the Druids—as Cæsar and Tacitus recorded them, and many writers have rendered familiar in modern times—to one who felt no curiosity in such details, what would the circle of these stones be? He would see nothing but a number of moss-grown fragments of rock, to be dismissed from his mind without a thought. But what pleasure would such a contemplation afford to him who had imbued his mind, in some measure, with the strange traditions relative to the rude faith of our forefathers! and how much interest would he feel among those very stones by calling to mind some traces of their bloody rites or fantastic superstition!—(Cheers.) Can you doubt for a moment which traveller of the two would enjoy the greater pleasure?—(Cheers.) Or if, on the other hand, instead of turning to the left, he on the right travelled along the foot of the Cheviots, he would at nearly every step encounter remains of the majestic Roman wall, which, to one ignorant of, or indifferent to, the history of Rome would seem so many tufts of matted ivy or blocks of cemented brick. But he

who knew something already, and who wished to know more, of the traces of that wonderful people, who fortified an island as we would a town, and constructed works so remarkable in character and magnificence, would derive fresh delight from every vestige of antiquity, enhancing the natural beauties around, and lending an enchantment to the distant view, which he that was destitute of the previous information would be compelled to forego—(Cheers). I should be anxious if I were able to impress on you that literature is not a mere holiday thing, to be assumed on some special occasion, but that it may mix and blend itself with the affairs of every-day life, with our hours of pleasure, with our days of excursion, not only without diminishing pleasure, but with a considerable increase and enhancement of it. Believe me, the pleasures of reading deserve most careful cultivation. See, as to other pursuits, pleasures, and objects of attainment, how much depends on circumstances within the power of those around us, on the flourishing or depressed state of an interest or profession, on connections, on friends, on the prevalence of one party or another in the state. In the pleasures, on the other hand, how much is at all times within your own reach—how little you depend on any one but yourselves. While saying this, I do not mean, of course, to forget for a moment our entire dependence on that Almighty Being, who may, if He so will, strike with blindness the studious eye, or afflict with incapacity the inquiring and discerning mind. But, subject to that Almighty Power, to which, under all circumstances and at all times, we are subject, see how little the man who can rely on the pleasures of reading is dependent on the caprice or will of his fellow-man; see how much there is within his own power and control—how reading, if his circumstances have not been thwarted by the fortuitous events to which I have referred, either assists to better his condition, or, failing in that, to procure oblivion from it when communing with the great and good of other days. Surely, then, all those who feel—and who does not?—the varieties and vicissitudes of human life ought, on that very account, if he be wise, to cultivate in himself, and also to promote in others, an enlightened taste for reading—(Cheers). Of the pleasures of reading I will say this—there is no one so high who is enabled to dispense with them, and there is no one so humble who should be compelled to forego them—(Cheers). Rely on it that in the highest station hours of lassitude and weariness will intrude unless they be cheered by intellectual occupation. Rely on it, also, that there is no doom so toilsome, so devoted to the cares of this world and to the necessity of providing daily bread, but will afford intervals, if you will only seek them out, in which pleasures may be cultivated and oblivion of your other cares enjoyed—(Cheers). Depend upon it these are pleasures which he who condemns will find himself a miserable loser in the end. It is with views like these that you have founded the present institution to encourage and promote as far as possible a taste for intellectual pleasures. On that ground it deserves and, I am sure, will receive support. I am convinced that, conducted, as I trust it always will continue to be, with skill and judgment, the principle of this institution is so sound that it must prevail. You cannot, indeed, expect that an institution of this kind should be equally flourishing at all periods of the fluctuating transactions of business from year to year; but of an institution on the principle I have described, and under the management which I anticipate to continue, I will venture to predict that it will keep its ground amidst your difficulties, whilst, on the other hand, it will grow with your growth and prosper with your prosperity—(Cheers). I believe that this institution contains within it a sure principle of vitality, because I believe it contains within it the principle of usefulness—(Loud cheers). Sow the good seed, and rely on it that your harvest, whether retarded by a passing cloud or quickened by a genial sun—whether late or early—your harvest will be plentiful and your reward secure. [The noble viscount resumed his seat amidst loud and prolonged cheering.]

Mr. T. M. Gibson next addressed the meeting on the social and moral advantages of education. The tendency of the age was to give the people at large more and more influence over public affairs, and it became proportionately more important, by the general diffusion of knowledge, by the development of intellect and moral training, to fit them for the exercise of those powers which undoubtedly they would sooner or later possess. In order to raise the morals and improve the taste of the community, every man who desired the permanent welfare of his country should promote that and other kindred institutions—(Cheers).

Mr. J. D. Morell, Mr. J. Bell, and Mr. Godwin next addressed the assembly. After which Mr. Bright delivered a long and eloquent speech, lamenting the want of appreciation under which they all laboured of the value of time, and dwelling on the advantages which such institutions as the Athenæum offered. The people were, remarked the speaker, more occupied with amusement and frivolity than with the hard study and laborious exertion necessary to enable them to participate fully in the advantages presented to them. He did not undervalue what was called light reading, or magazine literature, much less would he discourage the reading of newspapers, which gave us, in fact, the history of our own times—and no man could know where he stood in the world unless he looked frequently into the newspapers of the day—but from the age of fifteen to twenty-five young men should chiefly devote themselves to the careful study of good books in history and biography, which they ought to select with as much caution as they would their associates. He did not think the middle-class young men of Yorkshire and Lancashire were so educated as to fit them for the active duties of life; therefore he strenuously advocated the establishment of an university for the education of sons of commercial men.

Mr. Philips having moved a vote of thanks to Lord Mahon, it was seconded by Mr. Crossley.

Mr. Brotherton, in supporting the motion, referred to the invention of the Stanhope press by Lord Mahon's grandfather, and the valuable assistance he had lent, towards the close of last century, in overcoming the engineering difficulties of the Bridgewater Canal.

Lord Mahon having briefly returned thanks, three cheers were given for "Lady Mahon and the Ladies," and shortly after dancing commenced, and was continued till a late hour.

CAOUTCHOUC.—ITS NATURAL HISTORY; ITS PHYSICAL AND CHEMICAL PROPERTIES.

About the beginning of the eighteenth century, a substance called caoutchouc was brought as a curiosity from America. It was soft, wonderfully elastic, and very combustible. The pieces of it that came to Europe were usually in the shape of bottles, birds, &c. This substance is very much used in rubbing out the marks made upon paper by a blacklead pencil; and, therefore, in this country it is often called indian-rubber. Nothing was known of its production, except that it was obtained from a tree, till the French academicians went to South America in 1735, to measure a degree of the meridian. M. de la Condamine sent an account of it to the French Academy in the year 1736. He told them that there grew in the province of Esmeraldas, in Brazil, a tree called by the natives Hhevé; that from this tree there flowed a milky juice, which, when inspissated, was caoutchouc. Don Pedro Maldonado, who accompanied the French academicians, found the same tree on the banks of the Maragnon; but he died soon after, and his papers were never published. Mr. Fresnau, after a very laborious search, discovered the same tree in Cayenne. His account of it was read to the French Academy in 1751.

It is now known that there are at least two trees in South America from which caoutchouc may be obtained; the hævea caoutchouc, and the jatropha elastica; and it is exceedingly probable that it is extracted also from other species of hævea and jatropha. Several trees likewise which grow in the East Indies yield caoutchouc; the principal of these are, the ficus indica, the artocarpus integrifolia, and the ureeola elastica; a plant discovered by Mr. Howison, and first described and named by Dr. Roxburgh. Dr. Benjamin Smith Barton is said to have obtained it from the juice of the smilax caduca, which grows abundantly in the neighbourhood of Philadelphia. Mr. Woodcock found it in the milky juice of the asclepias vincetoxicum. It is said also to be furnished by the castilleja elastica, cecropia peltata, hippomene biglandulosa, and ficus religiosa. Even the papaver and lactuca are said to yield it. Probably more than one species of caoutchouc exists; but this has not yet been established by experiment. Great quantities of it are now imported into this country both from South America and the East Indies, being employed in the manufacture of Mr. Macintosh's waterproof cloth.

When any of these plants is punctured, there exudes from it a milky juice, which, when exposed to the air, gradually lets fall a concrete substance, which is caoutchouc.

Caoutchouc was no sooner known than it drew the attention of philosophers. Its singular properties promised that it would be exceedingly useful in the arts, provided any method could be fallen upon to mould it into the various instruments for which it seemed particularly adapted. Messrs. de la Condamine and Fresnau had mentioned some of its properties; but Macquer was the first person who undertook to examine it with attention. His experiments were published in the "Memoirs of the French Academy" for the year 1768. They threw a good deal of light on the subject; but Macquer fell into some mistakes, which were pointed out by Mr. Berniard, who published an admirable paper on caoutchouc in the seventeenth volume of the "Journal de Physique." To this paper we are indebted for the greater number of facts at present known respecting caoutchouc. Mr. Grossart and Mr. Fourcroy have likewise added considerably to our knowledge of this singular substance; both of their treatises have been published in the eleventh volume of the "Annales de Chimie." The latest set of experiments on it was made by Mr. Faraday, and we are indebted to Dr. Dalton for an analysis of the volatile oil into which it is converted by distillation.

Caoutchouc is not altered by exposure to the air; it is perfectly insoluble in water; but if boiled for some time its edges become somewhat transparent, owing undoubtedly to the water carrying off the soot; and so soft that when two of them are pressed and kept together for some time they adhere as closely as if they formed one piece. By this contrivance pieces of caoutchouc may be soldered together, and thus made to assume whatever shape we please.

When caoutchouc has once become solid, it cannot be dissolved in water, alcohol, acids, or alkalis. By long boiling in water it softens and swells up, and while in that state it is acted on with greater facility by different menstrua, but when exposed to the air it soon resumes its former state. By this treatment the black South American caoutchouc becomes translucent on the edges, obviously by the removal of the soot.

Caoutchouc is soluble in ether. This property was first pointed out by Macquer. Berniard, on the contrary, found that caoutchouc was scarcely soluble at all in sulphuric ether, which was the ether used by Macquer, and that even nitric ether was but an imperfect solvent. The difference in the results of these two chemists was very singular; both were remarkable for their accuracy, and both were too well acquainted with the subject to be easily misled. The matter was first cleared

up by Mr. Cavallo. He found that ether, when newly prepared, seldom or never dissolved caoutchouc completely; but if the precaution was taken to wash the ether previously in water, it afterwards dissolved caoutchouc with facility. Mr. Grossart tried this experiment, and found it accurate. It is evident from this that these chemists had employed ether in different states. The washing of ether has two effects. It deprives it of a little alcohol with which it is often impregnated, and it adds to it about one tenth of water, which remains combined with it. Alcohol precipitates the caoutchouc from this solution.

When the ether is evaporated, the caoutchouc is obtained unaltered. Caoutchouc, therefore, dissolved in ether, may be employed to make instruments of different kinds, just as the milky juice of the hævea; but this method would be a great deal too expensive for common use.

Caoutchouc is soluble in volatile oils; but, in general, when these oils are evaporated, it remains somewhat glutinous, and, therefore, is scarcely proper for those uses to which, before its solution, it was so admirably adapted. Coal naphtha was found by Mr. Macintosh capable of dissolving caoutchouc by the assistance of a long-continued heat. It is this solution, spread in numerous coats between two folds of cloth, that renders the cloth water-tight. The quantity of naphtha required for this solution is now so great that enough of it cannot be procured for the purpose, notwithstanding the numerous coal-gas works scattered over Great Britain. Great quantities of oil of turpentine are also employed; for it has been long known that oil of turpentine and coal naphtha are almost identical in their properties.

Caoutchouc dissolves both in the fixed and volatile oils; but when the solutions are dried the caoutchouc remains in an adhesive state and destitute of elasticity. According to Achard it is not soluble in oils of lavender, cloves, cinnamon, nor linseed, nor in Dippel's animal oil. But this statement is not likely to be correct. Lampadius found that when put into four times its weight of bisulphuret of carbon it becomes soft. If in this state we put it into sixteen parts of new bisulphuret of carbon, and stir the whole frequently, we obtain in a few days a milky liquor, which leaves the caoutchouc, when evaporated, in its original elastic state.

The acids act but feebly upon caoutchouc. Sulphuric acid, even after a very long digestion, only chars it superficially. The proportion of charcoal obtained in Mr. Hatchett's experiments was only twelve per cent., and he could observe no traces of artificial tannin. But when heat is applied the caoutchouc is completely decomposed. When treated with nitric acid there came over azotic gas, carbonic acid gas, prussic acid gas; and oxalic acid is said to be formed. Muriatic acid does not affect it. The other acids have not been tried.

When heated to a temperature of about 248° it melts, and, on cooling, remains in a semifluid adhesive state, somewhat like tar, or rather turpentine. In this state, in close vessels, it remains unaltered for years, but when spread in thin layers, and exposed to the air, it gradually, but verys lowly, acquires hardness. After fusion it still continues insoluble in alcohol of 0.815, or nearly so. It is equally little soluble in the caustic alkalis.

When caoutchouc is heated sufficiently in the open air it smokes, giving out an odour which is not disagreeable; it then catches fire and burns with a strong yellow flame, giving out much smoke. It was ascertained some years ago, by Messrs. Beale and Enderby, of London, that when caoutchouc is distilled in close vessels it furnishes 83⅓ per cent. of volatile oil. There passes off at the same time a quantity of combustible gas, but neither carbonic acid, water, nor ammonia. This seems to show that caoutchouc contains neither oxygen nor azote.

The oil has at first a dark colour, but when repeatedly rectified it becomes limpid and colourless, and has a specific gravity of only 0.640. It begins to boil at 95°, but during the boiling it rises as high as 149°. It is obvious from this that it is not homogeneous. Its boiling point, as determined by Dr. Dalton, is 108°. And the elasticity of the vapour is nearly the same as that of ether at the same temperature. It evaporates rapidly, and the evaporation is attended with the evolution of a good deal of cold. Dr. Dalton found that its vapour was not absorbed by water. Of course air or oxygen gas impregnated with it over water acquired a certain augmentation of bulk according to the temperature, which augmentation of bulk was permanent.—*Abridged from Thomson's Chemistry of Vegetable Organic Bodies.*

THE CHOLERA.

Cases Already Reported.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
In London and vicinity ..	388	208	95	85
In the Provinces	75	43	10	21
In Scotland	752	368	115	269
Total	1215	610	220	375
Reported this 21st of Nov., 1848.				
In London and vicinity—viz.,				
Whitechapel	3	1	—	—
Lambeth Workhouse..	1	1	—	—
Kennington	1	1	—	—
Newington	1	1	—	—
Barkingside, Essex....	1	...	1	—
Chelsea	1	—	—	—
In the Provinces—viz.,				
Blyth	2	4	—	—
In Scotland—viz.,				
Edinburgh	11	2	6	—
Leith	5	2	1	—
Glasgow	4	4	—	—
Total new cases ..	30	16	8	—

General Board of Health, Nov. 21.

THE BILLS OF MORTALITY.

The number of deaths according to the return of the Registrar-General for last week amounts to 1,188, being 34 above the weekly average of the five years ending 1847. Of these 386 are from zymotic diseases, being 116 above the average; from tubercular diseases, 155, being 29 below the average; diseases of the brain, &c., 123, being 4 below the average; diseases of the heart and bloodvessels, 30, being 8 below the average; diseases of the lungs and other organs of respiration, 185, being 37 below the average; diseases of the stomach, liver, and other organs of digestion, 73, being 9 above the average; from smallpox, 28, being 9 above the average; measles, 19, being 25 below the average; scarlatina, 119, being 72 above the average; whooping-cough, 26, being 8 below the average; diarrhœa, 26, being 5 above the average; dysentery, 7, being 2 above the average; from cholera, 54, being 53 above the average; typhus, 70, being 20 above the average; consumption, 110, being 24 below the average. The number of births during the week was 1,291.

The deaths from cholera since October 14 have been:—In the west districts, 18; north, 12; central, 5; east, 34; south, 221; in all, 290. It will be observed that of the 290 deaths from cholera not fewer than 221 have occurred on the south side of the Thames. The following is a detailed statement of the deaths from cholera. Three are cases in which inquests were held; the remainder are nearly all certified by medical attendants:—

St. James, Westminster; Berwick-street.—At 39, Berwick-street, wife of a designer of military coats, 27 (*post-mortem*), "cholera induced by intemperate habits; doubtful whether Asiatic cholera; found dead in bed."—Inquest.

St. Pancras; Somers-town.—Daughter of a waterman, 4, "English cholera (6 days)."

Hackney; Stamford-hill.—M. 60, "Asiatic cholera (21 hours)."

Shoreditch; St. Leonard's.—At 7, Cook's-walk, White Bear-gardens, Kingsland-road, wife of a labourer, 40, "Asiatic cholera (48 hours)." Mr. Yarrow, the registrar, states that "The deceased resided in a very damp and unhealthy situation, with a drain of dirty water in front, and an open sewer in the rear. Several pigsties are erected against the back doors of the cottages, and indeed the whole place presents an accumulation of filth. The deceased, whose husband was employed in the parish stoneyard, lived in extreme poverty, and scarcely ever tasted animal food. The death occurred on the 16th inst., and since that time a child has been attacked with diarrhœa." The Rev. William Denton, curate of the parish, makes the following communication:—"Cook's-walk consists of a row of tenements, low, small, and excessively damp. I do not remember a time when typhus, scarlet fever, or smallpox was not in some one or another of the five or six houses which comprise the row. So far as I can ascertain, the case to which I now call your attention is the only one of death from Asiatic cholera that has occurred in the district of the parish church of St. Leonard's."

Bethnal-green; The Green.—M. 2, "Asiatic cholera (4 days);" M. 5, "Asiatic cholera (4 days);" F. 45, "cholera (28 hours);" F. 29, "Asiatic cholera (9 days)."

Whitechapel; Mile-end New-town.—At 3, Pelham-street, M. 3, "debility;—malignant cholera (about 30 hours)."

St. George's-in-the-East; St. Paul.—F. 36, "diarrhœa (3 days); spasmodic cholera (10 hours)."

Stepney; Ratcliff.—F. 37, "Asiatic cholera (2 days)."

Poplar; Bow.—M. 30, "Natural death, sudden, from cholera;" inquest. [This person was a tobacco-pipemaker, and resided in Frederick-street, Bromley, where some of the houses are in a state of excessive filth from the want of necessary arrangements. The street is chiefly occupied by Irish, and is the receptacle for all the waste vegetable and animal substances of about 100 houses. Each house has four rooms, and in most cases a family in each room.] F. 45, "cholera (13 hours);" F. 43, "cholera (48 hours);" F. 36, "cholera (16 hours)." (These women were inmates of Grove-hall Lunatic Asylum, Bow.)

St. Saviour; Christchurch.—At 19, Bear-lane, wife of a labourer, 29, "cholera (7 days); typhus (4 days)."

St. Olave; St. Olave and St. Thomas.—At 4, Tattle-court, on Nov. 11, daughter of a labourer, 10, "Asiatic cholera (2 days); typhus (7 days);" at 43, Tooley-street, Nov. 13, surgeon, 40, "spasmodic cholera (5 days)." St. John.—M. 7, "Asiatic cholera (60 hours.)"

Bermondsey; Leather-market.—M. 36, "cholera (8 hours);" F. 6, "cholera (48 hours);" F. 16, "Asiatic cholera." St. Mary Magdalen.—M. 5, "cholera;" M. 1, "cholera;" F. 7, "cholera."

St. George's, Southwark; Kent-road.—At 122, Kent-street, son of a labourer, 6, "cholera (12 hours);" at 1, Board's-buildings, daughter of a labourer, 5, "cholera;" at 8, Pleasant-place, wife of a messenger, 31, "cholera (2 days);" F. 18 months, "choleric diarrhœa (2 hours);" M. 3, "Asiatic cholera (3 days)." London-road.—M. 50, "Asiatic cholera;" F. 36, "cholera (20 hours)."

Newington; St. Mary.—M. 46, "cholera (7 hours);" F. 2, "English cholera (8 days) cerebral congestion." Walworth.—F. 35, "English cholera (6 days); convulsions; 3 fits (12 hours)." Mr. Turner, the registrar, states that "the deceased was stewardess of the Trent mail steamer, and had come on a visit to Walworth, while the ship lay at Southampton. On the

day after her arrival she was seized with violent vomitings and diarrhœa, but without pain. She was cleanly and temperate in her habits. The house was clean, but there is no drainage in the neighbourhood." Trinity.—At 9, Chatham-place, North Lock's-fields, M. 9, "cholera (36 hours)." The house is situated on the bank of an open sewer. At 1, Cottage-place, County Terrace-street, New Kent-road, M. 3, "Asiatic cholera (24 hours)." This house, which is damp and badly drained, is situated in a narrow passage three yards wide, with an archway at one end, where is always a quantity of vegetable and animal matter in a state of decomposition. At the same house, F. 7, "Asiatic cholera (5 days)."

Lambeth; Waterloo (1st part).—Daughter of a combmaker, 11, "cholera (15 days), well (3 days), typhus (9 days);" wife of a combmaker, 35, "cholera (4 days), miscarriage on second day—exhaustion;" daughter of a combmaker, 9, "cholera (4 days), diarrhœa, cramps." (Mr. Mears, the registrar, states that "these three cases occurred in a family in Mitre-place, Broadwall. Mr. Dawson, the surgeon, attributes the disease to a foul atmosphere arising from bad drainage; two other children have been attacked, but are likely to recover.") Waterloo (2d part).—At 29, Jurston-street, wife of a sofa-maker, 40, "cholera (11 hours)." Lambeth Church (1st part).—M. 3, "English cholera (14 hours)." Lambeth Church (2d part).—At 3, Charles-place, Union-street, son of a labourer, 15, "cholera (7 days), fever (3 days)."

Camberwell; Sub-District Camberwell.—In Lunatic Asylum, Peckham-house, M. 20, "spasmodic cholera (87 hours);" in the same house, M. 27, "spasmodic cholera (15 hours);" in the same house, F. servant, 25, "spasmodic cholera (23 hours)."

Rotherhithe; Sub-District Rotherhithe.—M. 35, "cholera (10 hours);" F. 9, "Asiatic cholera (15 hours)."

Greenwich; Woolwich Dockyard.—M. convict, 63, "Asiatic cholera (9 days)"—Inquest; ——— Greenwich, East; M. 67, "English cholera with typhus (30 hours);" ——— Greenwich, West; in Dreadnought Hospital, M. 17, "cholera;" in same ship, M. 23, "cholera, followed by sore throat and diffuse cellular inflammation."

Wandsworth; Clapham.—M. 3, "diarrhœa (12 hours), cholera (2 hours)."

CHEMICAL PATENTS.

PATTINSON'S IMPROVEMENTS IN THE MANUFACTURE OF SODA.*

The operation for converting common salt into carbonate of soda is now so generally understood that but few prefatory remarks are required to the description of Mr. Pattinson's patent.

The salt (chloride of sodium) having been decomposed by the agency of sulphuric acid, and sulphate of soda having been formed, the latter is mixed with certain portions of coal and chalk, and heated to incipient fusion in a furnace called the ball furnace. During the whole of this process of heating the success of the operation requires that the partially fused mass be assiduously stirred. Hitherto this has been effected by hand, a most laborious process.

Mr. Pattinson endeavours to find a substitute in the mechanical aids of revolving knives or incorporators, actuated by machinery. But, inasmuch as the metallic agitators might be fused by long exposure to heat, Mr. Pattinson has devised a plan for enabling water to percolate through the hollow axle of the shaft and arms to which the incorporators are attached.

The flow of water through the shaft and arms is regulated so that it passes off at a temperature of about 160°, which will effectually prevent injury to the apparatus. The arms are entirely above the mass in the furnace, the scrapers only being in contact therewith.

In conclusion, the patentee remarks that although he has given the exact details of machinery which he prefers to employ for the purpose described, yet that he does not confine himself thereto, so long as machinery is caused to act in a similar manner on matters in furnaces employed in this branch of manufacture; and he states his claim substantially to be, first, the stirring of matters contained in decomposing, balling, carbonating, and drying furnaces used in the manufacture of soda by machinery erected in such furnaces.

Secondly, cooling the machinery so used by circulating water through the interior of the same.

* William Watson Pattinson, of Felling, near Gateshead, Durham, chemical manufacturer, for improvements in the manufacture of soda. Patent dated Jan. 27, 1848; enrolled July 27, 1848.

PATENTS RECENTLY INITIATED.

James Anderson, of Abbotsford-place, in the county of Glasgow, N.B., starch-manufacturer, for a certain improved mode of separating the different qualities of potatoes and other vegetables. Patent dated November 11, 1848, six months.

Alexander Parkes and Henry Parkes, of Birmingham, for improvements in the manufacture of metals, and alloys of metals, and in the treatment of metallic matters, with various substances. Patent dated November 11, 1848, six months.

John Browne, of Osnaburgh-street, Middlesex, gentleman, for improvements in fire-escapes, and in apparatus to facilitate persons employed in cleaning windows. Patent dated November 11, 1848, six months.

Alexander Balfour, of Dundee, in the kingdom of Scotland, leather merchant and manufacturer, for improvements in apparatus for cutting metal washers and other articles, and in the construction of buffers. Patent dated Nov. 11, 1848, six months.

Samuel Adams, of West Bromwich, Stafford, organist, for improvements in mills for grinding. Patent dated November 16, 1848, six months.

William Wilkinson, of Farrow, near Gateshead, in the county of Durham, coke-manufacturer, for certain improvements in the construction of coke ovens, and in the machinery or apparatus to be connected therewith. Patent dated November 16, 1848, six months.

PATENTS RECENTLY EXPIRED.

J. Walton, of York, cloth dresser and finisher, for certain improvements in the machinery used for raising the pile of woollen and other cloths. Patent dated November 12, 1834; expired Nov. 12, 1848.

J. M. Cramer, of Middlesex, for an improved steam-engine. Patent dated November 13, 1834; expired November 13, 1848.

L. W. Wright, of Chelsea, engineer, for certain improvements in machinery or apparatus for making paper. Patent dated November 15, 1834; expired November 15, 1848. (Communication.)

C. de Berguc, of Clapham, engineer, for certain improvements in machinery for spinning or twisting cotton, flax, silk, and other fibrous substances. Patent dated November 15, 1834; expired November 15, 1848.

E. G. Giles, of Middlesex, gent., for certain improvements in apparatus for engraving on copper and certain other substances. Patent dated November 15, 1834; expired November 15, 1848. (Communication.)

S. Gardner, of London, gent., for an improvement in the art of multiplying certain drawings and engravings, or impressions. Patent dated November 15, 1834; expired November 15, 1848. (Communication.)

Ointment for Fistula in Horses—Take 4 ounces of ointment of yellow resin, 1 ounce of oil of turpentine, and ½ ounce of verdigris; mix, to form an ointment.

TO OBTAIN CRYSTALLINE QUININE AND CINCHONINE FROM QUINOIDINE.

By F. RODER.

Dissolve one part of commercial quinoidine in four parts of spirits of wine of 30° Beck, and mix this with half a part of chloride of tin in two parts of water. A dark, resinlike mass is hereby separated, and the remaining liquor is but slightly coloured; this should be immediately filtered and thrown down with ammonia. After washing and drying the precipitate the alkaloid is again dissolved in spirits of wine, and the alcoholic solution is mixed with half the former quantity of chloride of tin, and precipitated at once with ammonia. Out of this precipitate, after washing and drying, the alkaloid is, as in the first instance, dissolved. The solution is quite colourless, and, after saturation with dilute sulphuric acid, yields, on evaporation, crystals of sulphate of quinine.

In the ammoniacal liquor from which the oxide of tin and the quinine precipitates were obtained, and in the washing, cinchonine is found dissolved; this may be thrown down with infusion of nutgalls, as tannate of cinchona, and so on.

The resinous precipitate thrown down by the chloride of tin yet retains a certain amount of quinine, which is to be extracted with spirits of wine, and which may be again purified as above with chloride of tin. The resinous substance has the characterisic smell of chinoidine, a bitter taste, and basic properties.

From 100 parts of chinoidine the author obtained by the foregoing method from forty to forty-three parts of quinine, from nine to ten per cent. of cinchonine, and from twenty-eight to thirty per cent. of resin.—*Mittheilungeirder Schweitzer-Apotheker-Vereins*, 1 Jahr., s. 31.

SULPHATE OF SODA DETERIORATED BY ADMIXTURE WITH SULPHATE OF MANGANESE.

Manufacturers of chloride of lime who operate on a large scale, and who obtain chlorine from chloride of sodium by means of sulphuric acid and manganese, employ the residuum of distillation, which, probably, they merely saturate with lime, in the manufacture of sulphate of soda, or Glauber's salts. It is very probable that a portion of the neutral sulphate of oxide of manganese remains in solution, and may crystallize with the sulphates of soda. This source of the impurity of commercial Glauber's salts has not hitherto been noticed. As the sulphate of oxide of manganese has a similar degree of solubility in water, and crystallizes in as considerable prisms as soda, is somewhat reddish, and readily effloresces, the impurity here indicated may the more easily be overlooked. The purchaser of Glauber's salts should never omit to try the article by dissolving a portion of the same in hot water, and testing with a solution of chloride of lime, carbonate of soda, and hydrosulphuret of ammonia, by none of which, as is well known, is pure sulphate of soda either coloured or rendered turbid.—*Buehner's Repertorium*, part 1, vol. i., third series.

Dr. Merck, jun., describes in this number the properties of a new alkaloid, which he believes he has derived from the milky juice of the poppy. It was in the residuum of the materials employed in the preparation of morphine that he discovered this alkaloid, to which he has given the name of *papaverin*. It crystallizes from the alcoholic solution in a number of white, lanciform crystals, obeying no apparent arrangement; from ether the crystals are deposited in large needles. In cold spirit of wine it is with difficulty soluble, but more readily when heat is applied. It is also less soluble in cold ether than in warm. It is insoluble in water. The solution scarcely turns red litmus paper blue. When concentrated sulphuric acid is poured over the crystals they become blue.

Papaverin forms with acids salts, for the most part insoluble in water. The muriatic salt gives with chloride of platinum a yellow precipitate which is insoluble in water, and in spirits of wine is insoluble.

The analysis of free papaverin, of the muriatic salts of the same, and of the platina double salts, gives the following formulæ :—

Papaverin—C^{40}, H^{21}, NO^{8}.

Muriate of papaverin—C^{40}, H^{21}, NO^{8}, ClH.

Platina double salt—C^{40}, H^{21}, NO^{8}, ClH, Pt Cl^{2}.

From the above it would appear that the new alkaloid is a lower oxide of narcotine (C^{40} H^{20} NO^{12}), just as morphine (C^{35} H^{20} NO^{6}) is, on the other hand, a higher oxide of codeine (C^{35} H^{20} NO^{5}).—*Ann. d. Chem. u. Pharm.*, l. xvi., 125.

M. FORCHHAMMER'S RESEARCHES ON THE COMPOSITION OF SEA-WATER.

M. Forchhammer has prosecuted some valuable inquiries relative to the composition of sea-water. In the performance of his experiments he has had recourse to some ingenious methods to determine easily, and with great precision, the quantity of salt which it contained.

He first rendered acid by means of nitric acid a given volume of sea-water, and then added a determinate volume of nitrate of silver. By this method he was able to appreciate the smallest variations in the quantity of salt which the sea-water contained.

According to M. Forchhammer the part of the ocean most rich in salt is the Mediterranean Sea, in the vicinity of the Island of Malta. It contains 37.177 thousandths of solid matter, in which 20.046 thousandths are chlorine.

The saline constituents of the west portion of the Atlantic Ocean are subject to but very little variation. Water, which was examined in the years 1844-45, taken from latitudes of 60°, 61°, and 62° north latitude, between the longitudes of 5° and 23° west from Greenwich, contained as a mean 19.45 thousandths of chlorine (minimum 19.412, maximum 19.515) for every thousand parts of solid matter.

The saline constituents sensibly diminish towards the coasts, even those of the smallest islands.

At Thorshavn, and near the isles of Fœroe, the ocean contains but 18.885 parts per thousand of chlorine. The water of the North Sea in no part contains 19 parts in a thousand of chlorine ; between Bergen and the Orkneys it contains 18.997. At the south coast of Egersund it merely contains 18.278 ; in the Cattegat still less. In the month of August, 1844, it only contained 11.077 ; and during the winter the sea near Kullen, in Scania, only contained 6.212 parts in every thousand.

Of all the elements in sea-water chlorine is that which is subject to the least amount of variation. Sulphuric acid, which can be as easily discovered as chlorine, is found to vary much more than that element. In the course of a series of experiments made on the waters of the Atlantic Ocean it was found that the sulphuric acid varied to the extent of 2.289 to 2.436 parts per thousand. This water contained between 0.595 and 0.598 per thousand of lime, and its magnesia varied from 2.116 to 2.209 per thousand. The water of the Mediterranean contains a little more lime than the Atlantic Ocean, that is to say, as 0.640 to 0.676 ; but the quantity of magnesia is not augmented in a parallel manner. Thus, near Gibraltar the water only contains 2.133, at Malta 2.074, and at Corfu 1.826.

During his analysis of sea-water drawn from great depths M. Forchhammer arrived at the conclusion, unexpected as it was invariable, that, when the bottom consists of argillaceous clay, that is to say, when it consists of silicate of alumina and carbonate of lime, the water becomes more rich in lime and more poor in magnesia. One part of the carbonate of lime is replaced by the magnesia of the sulphate of that base existing in the water, and forming a double silicate of magnesia and alumina. When the bottom is made up of broken shells, of chalk, or quartose sand, the quantity of magnesia in the water does not change.

This circumstance contributes to reinstate the ocean water in the carbonate of lime which had been removed from it by the shells.

The experiments of M. Forchhammer have sufficiently advanced the study of the elements dissolved in sea-water to induce us to hope that before long the quantitative composition of the ocean in various regions will be determined with considerable exactitude.

M. Backs, having analyzed a portion of the North Sea, near Heligoland, determined that its composition was as follows :—

Chloride of sodium	23.58
" potassium	0.01
" magnesium	2.77
Sulphate of magnesia	1.99
" lime	1.11
	30.53

The specific gravity of this water was found to be 1.0234, at 15° C.

METHOD OF DISCOVERING MERCURY IN MEDICO-LEGAL INVESTIGATIONS.*

The following method has been proposed by MM. Danger and Flandin. Some part of the body being selected (the liver in preference) is mixed with one third or one half its weight of concentrated sulphuric acid. The mixture is then heated to about 100° C. until all is dissolved. For this purpose one hour, or an hour and a half, is required. After this the mass is allowed to cool.

This being done, some well-saturated hypochlorite of lime is added with access of air. The whole is now agitated with a glass rod, and a little water added, by degrees, as the mixture is seen to become thick and white. This operation is continued until one part of the mass being filtered yields a colourless liquor. In general, as much of the hypochlorite is required as is equal in quantity to the sulphuric acid.

The mass is now moistened with cold anhydrous alcohol, afterwards with water, filtered, and the residue washed many times with water. In this liquor the mercury is precipitated upon a plate of gold, which serves as the electro-negative electrode of the electric current. This being done, the mercury is separated from the gold by distillation.

This method is attended with the inconvenience of many others for discovering the same metal, namely, it is incompetent to determine whether the mercury be developed from calomel or from the bichloride (corrosive sublimate).

* Danger and Flandin, "Journ. de Chim. Médicale," 1845, p. 214.

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—I am greatly obliged to your correspondent "Veritas" for pointing out an additional error in the report on steam-coal by Sir H. de la Beche and Dr. Lyon Playfair. If anything was wanting to confirm the justness of my observations, it has now been supplied. The slovenly carelessness with which that whole job has been slurred over could have found no better exponent than is afforded by the fact that the word "gramme" is frequently misprinted "grain," in a report solemnly laid before the highest authorities in the kingdom, and ultimately, with all its blushing errors thick upon it, "presented to both Houses of Parliament by command of her Majesty." Even, however, when corrected who would pretend to determine anything practical from four grains of coal? Yet I have no hesitation in believing the statement of "Veritas ;" it is perfectly in accordance with the rest of the report ; and, as a corollary upon the blunder he points out, I will briefly advert to the plan pursued for the determination of the amount of combustible matter in the residue or ashes from the furnace of the Admiralty boiler. The method "consisted in heating the powdered substance in a stream of oxygen gas, by which the organic matter was dissipated chiefly as carbonic acid and water, and estimating the loss as combustible matter." The ashes in question appear to have contained chiefly carbon, silica, alumina, oxide of iron, sulphuret of iron, and lime. The existence of sulphuret of iron seems unquestionable, and is even alluded to in one part of the report, independently of which the invariably copious evolution of sulphuretted hydrogen from coal-ash by the action of muriatic acid is decisive of this question. In passing a stream of oxygen gas over such a compound as the above, heated to redness, the carbon would certainly pass off, attended by a diminution of weight ; but the iron and sulphur would absorb oxygen, and increase the weight, thereby diminishing the apparent amount of carbon. If, however, the lime present was insufficient to saturate the sulphuric acid formed, then this would fly off, and the sulphur thus evolved would be regarded as carbon, since the loss of weight was considered as due to carbon. With such a series of complicated changes the result is inevitable. The subject is, indeed, one of very little importance, for if the ashes would not burn in the furnace they might with great propriety have been thrown away as useless in a practical point of view ; and I merely remark upon the matter in order to corroborate your correspondent's assertion, and prove that, whether in printing or in operating, the same blundering tendency has prevailed throughout.

The pedantic foppery evinced in the use of the gramme weight is not, perhaps, unworthy of notice here. In France, where all weights, measures, and even many coins, are exact multiples of the gramme, its advantages are obvious and decisive ; but I defy the most enthusiastic admirer of the decimal system to point out one single instance in which its use is even admissible in this country. The gramme is not a multiple of any weight or measure used by us, for even our grain weight, small as it is, will not divide it accurately, whereas the grain weight itself is easily raised to pounds, or tons, or pints, or gallons, or any large weight or measure which we possess ; for practical use it is, indeed, all-sufficient, and the only weight which could be regarded as superior to it for scientific purposes would be a weight so small as to differentiate every known weight and measure in the world, and thereby abolish fractions. In practice the one thousandth of a grain would answer this purpose, and free us from the liability to error caused by the use of the decimal point, which is, perhaps, the greatest disadvantage we experience in the employment of the grain weight, but to which the gramme is even yet more obnoxious.

I am, sir, your obedient servant,

LEWIS THOMPSON.

Byker Bar, Newcastle-on-Tyne,
Nov. 21, 1848.

MISCELLANEA.

RECIPES FOR CEMENTS.

Canal Cement is prepared by reducing to powder and mixing 1 part of iron filings, 3 parts of flint, and 4 parts of alum combined with iron-rust, with 4 parts of brickdust, and 2 parts of hot lime. The whole is put into a wooden tub, and water added to make it liquid.

China Cement, for broken china, glass, or stone ware, is made by beating a quantity of quicklime into a very fine powder, sifted through muslin, and having thinly smeared the parts to be joined with white of egg, dust the powder over this, and unite the edges.

Coppersmiths' Cement, used in joining the edges of copper utensils, is prepared by mixing powdered quicklime with bullocks' blood. It must be applied fresh. It is formed on the same chemical principle as the china cement.

Diamond Cement—Melt together 7 or 8 parts

of resin and 1 part of wax, and mix with a small quantity of Paris plaster, for cementing stones and spar, which must be made hot.

Dutch Terras is composed of basalt and blue limestone ground to a fine powder, sifted, mixed with water, and well beaten together.

Floor Cement, for making earthen floors, is made by mixing two thirds lime with one third of coal ashes and a little clay, tempering the whole with water, and letting it stand a week, when it is again to be tempered. A superior sort may be made by using the powder of Paris plaster instead of ashes, and bullocks' blood instead of water.

Fireproof Cement—Add half a pint of vinegar to half a pint of milk, separate the curd, mix the whey with five whites of eggs, beat the whole well together, and add powdered quicklime to make it into a thick paste. It is used for uniting broken vessels, and is both fire and water proof.

Glass Grinders' Cement is made by boiling a due portion of pitch and stirring in fine sifted wood ashes till of a proper temper, and then a little tallow, if necessary.

Or, for small works, melt together a quarter of an ounce of beeswax and 4 ounces of resin, adding 4 ounces of whiting, previously made red hot.

Greek Cement is prepared by mixing lime and sand with milk or size, for outside walls.

Japanese Cement, or rice glue, is made by mixing rice flour intimately with cold water, and then gently boiling. It is beautifully white, and when dry is almost transparent. Papers pasted together by means of this cement will sooner separate in their own substance than at the joining, which makes it useful in the preparation of curious paper articles, as tea-trays, ladies' dressing-boxes, and other articles that require layers of paper to be cemented together.

Iron Cement is formed of the borings of cast-iron guns, or turnings of cast iron, which should be clean and free from dust until used. By slight pounding or triturating they are broken, but not powdered, and then coarsely sifted. At the time of using they are to be mixed with powdered sal ammoniac and sulphur, and slightly moistened with water, when the composition must be rammed or caulked into the joints, with a blunt caulking chisel and hammer, and the joints screwed up by its bolts as tightly as possible. No more of this cement must be made than can be used at one time, because it soon spoils; but, if good, it will become as hard as the iron itself in a few days: 2 ounces of hydrochlorate of ammonia and 1 drachm of sulphur is sufficient for 5 pounds of iron borings.

Isinglass or Turkish Cement is made by dissolving mastich in as much spirit of wine as will suffice to render it liquid; in another vessel dissolve as much isinglass, which has been previously soaked in water till it is swollen and soft, in brandy, as will make 2 ounces by measure of strong glue, and add two small bits of gum galbanum, or ammoniacum, which must be rubbed, or ground, till they are dissolved; then mix the whole with a sufficient heat; keep it in a phial stopped, and when it is to be used set in hot water.

Cement for Metals—Take of gum mastich 10 grains, and rectified spirit 2 drachms. Add 2 drachms of strong isinglass glue, made with brandy, and 10 grains of genuine gum ammoniac. Dissolve all together, and keep it stopped in a phial. When intended to be used, set it in warm water.

Mahogany-coloured Cement—Melt together 2 ounces of beeswax, and ½ ounce of Indian red, and a small quantity of yellow ochre, to bring it to the proper colour.

Mastich is used as a cement for cameos and brilliants, which are made to melt it.

Parker's Cement is made of very argillaceous limestone burnt in conical kilns, with a continued fire of pit coal, in the same manner as other limestone; but if the heat be so great as to cause a commencement of fusion in the cement, it will be totally spoiled. It is reduced to an impalpable powder by grinding, as soon as it is burnt, and is sent away in barrels, well closed. The above is much used in London for facing houses, and for the foundations of large edifices.

Roman Cement is made by mixing a barrel of hydrate of lime with 3½ pounds of sulphate of iron, 15 gallons of water, and half a bushel of fine gravel sand. The sulphate of iron should be dissolved in hot water; it must be stirred with a stick, and kept stirring continually while in use. This is the ordinary Roman cement; but the genuine Roman cement consists of the Pulvis buteolanus, or puzzolanum, a ferruginous clay from Puteoli, calcined by the fires of Vesuvius,—lime, and sand, mixed up with soft water. The only preparation which the puzzolanum undergoes is that of pounding and sifting; but the ingredients are occasionally mixed up with bullocks' blood and fat of animals, to give the composition more tenacity.

Turners' Cement, used by turners and other artisans, is made by powdering and heating to redness 16 parts of whiting, and, when cold, mixing it with 16 parts of black resin, and 1 part of beeswax, previously melted together, and stirring the whole into a paste.

Water Cement is prepared by mixing together and moistening with lime-water 56 pounds of coarse sand, 42 pounds of fine sand, and then adding to the mass 14 pounds of pure fresh-burnt lime, and while beating them up together gradually adding 14 pounds of bone ashes. The quicker the mixing is done the better.

Wire Cement, for pasting paper on wire, and used by confectioners, is made by mixing hair-powder with thick soaked gum arabic into a paste of the thickness of cream.

Astringent Ointment for Grease in Horses—Take 4 ounces of Venice turpentine, 6 ounces of hogslard; melt over a slow fire; when it is nearly cold, but still soft, add 2 ounces of acetate of lead, finely powdered, and stir till it is quite cold.

Or, take 4 ounces of hogslard, 2 drachms of oil of rosemary, 1½ drachm of white lead; mix, to make an ointment.

Blistering Ointment for Horses—Take 2 ounces of oil of turpentine, 1 ounce of sulphuric acid; mix carefully in the open air, or under a chimney, avoiding the suffocating vapour which arises, and then add 6 or 8 ounces of hogslard; 2 ounces of this rubbed up with 4 drachms of powdered cantharides will form a strong blister.

Digestive Ointment for Horses—Take 4 ounces of ointment of yellow resin, 1 ounce each of turpentine and nitric oxide of mercury, finely powdered; mix, to form an ointment to promote the suppuration of sores.

Or, take 4 ounces of ointment of nitrated mercury, 1 ounce of oil of turpentine; mix, to form an ointment.

Emetine, or Emetia, is prepared by macerating 1 ounce of pulverized ipecacuanha in 2 ounces of ether for some hours with a gentle heat, in a distillation apparatus. The portion that remains is boiled and triturated with 4 ounces of alcohol in which it has been previously macerated, filtered, and treated with alcohol again, until it ceases to imbibe anything from the powder. Mix all these and evaporate to dryness, macerate the extract in cold distilled water, filter again, and evaporate to dryness. The emetia thus prepared is in scales of a reddish brown, is inodorous, acrid, somewhat bitter, but not nauseous, like ipecacuanha, soluble in water, and deliquescent.

India Ink, or China Ink, is, when genuine, supposed to be procured from the smoke of resinous trees, but is otherwise made in this country, being a compound of lampblack, from the oil-lamps, beat into a mass with purified glue or isinglass, and scented with musk or amber. It may be imitated by charcoal made from cherry-stones or beans, and mixed with gum arabic; or with common lampblack beat up with gum, honey, seed lac, common glue, &c. Its goodness will appear at once from rubbing it down in a saucer with a little water, from its breaking splintery, and feeling soft and not gritty when rubbed against the teeth.

Honey Water — Aqua mellis — Is prepared with 1 gallon of Cognac brandy, 1 pound each of virgin honey and coriander seeds, 1½ ounce of cloves, 1 ounce of nutmegs, benzoin, and storax, four vanilloes, and the rind of three large lemons. Digest for two days, and distil with a gentle heat. Add to every gallon of the water thus procured a pint and a half each of orange-flower-water, and rose-water, and 5 grains each of musk and ambergris. Digest again for three days in a gentle heat; filter, and keep in a well-stopped bottle. Several other receipts are in use, but they do not differ much from this.

Hoffmann's Elixir—Take 1 drachm each of fresh orange-peel, extract of the blessed thistle, of cascarilla, of gentian, of erythræa centaurium, of yellow gentian, and of myrrh, and 2 pints of Spanish wine. Macerate the bark in the wine for two days; press and dilute the extracts; mix, and strain.

James's Powder was analyzed by Dr. G. Pearson, and found to contain 57 parts of oxide of antimony, partly vitrified, and 43 parts of phosphate of lime. Mr. R. Phillips has found the proportions of these to be 56 and 44. The original specification of James is:—"Take antimony, calcine it with a continued protracted heat, in a flat unglazed vessel, adding to it from time to time a sufficient quantity of any animal oil or salt, dephlegmated; then boil it in melted nitre for a considerable time, and separate the powder from the nitre by dissolving it in water." This specification is, as our readers will not fail to discover, ridiculous. That there is a regular and certain process for its preparation is proved by the similarity of the two analyses by Pearson and Phillips at a considerable distance of time.

Almond Paste—Take 4 lbs. of bitter almonds blanched and well dried, beat them in a mortar to a fine paste with lavender or Hungary water, or eau de Cologne. Add to the paste 1 pound of the best white-drained honey, 2 ounces of fresh oil of jasmine, ½ pound of the best almond-powder, and 4 ounces of fine Florentine iris-powder; beat, and mix the whole carefully. This will keep good for twelve months if no eggs, milk, or ox-gall be added.

Dentifrice Electuary—Take 4 ounces of prepared red coral, 1 ounce each of cuttle-fish bone and cinnamon, ½ ounce of cochineal, 10 ounces of Narbonne honey, ½ drachm of alum; pulverize the three first substances, and bruise together the two last with a small quantity of water till of a purple colour; then add the honey. Perfume it with one drop of any volatile oil to the drachm.

Gold-coloured Lacquer for Watch Cases and Keys—Take 6 ounces of seed lac, 2 ounces each of gamboge and amber, 24 grains of extract of red sandal-wood in water, 60 grains of dragon's blood, 36 grains of pure spirit of wine. First grind the amber, lac, gamboge, and dragon's blood on a porphyry slab; then, after making an infusion of the spirit of wine with the sandal-wood, mix the whole to make a varnish. The metal is heated when it is applied.

Eye-snuff—Triturate and mix well in a marble mortar 5 grains of sulphate of mercury, 2 scruples of liquorice-root powdered. Grimston and others disguise this by various ingredients. It is a powerful errhine in producing a discharge from the nose when snuffed up in small pinches, and in this manner may act on the eyes by stimulating the glands, but is not very safe.

Fumigating Pastils—Take 1 drachm of benzoin, ½ drachm each of nitrate of potass and cascarilla, 6 drachms of charcoal, 10 grains each of oil of cloves and nutmeg, 1 scruple of gum myrrh, and q. s. of gum tragacanth, to form a paste, which is to be dried.

Madder Lake, or Rubric, or Field's Lake—Tie up in a bag of fine strong calico 2 ounces of Dutch madder, put it in a stone mortar with a pint of clear soft water, and beat it well without tearing the bag. Pour off the coloured water, add more, and repeat the process till the water is no longer coloured. Heat till near boiling all the

coloured water in an earthen or silver vessel, pour into a basin, add 1 ounce of alum dissolved in a pint of boiling water, stirr, and add 1½ ounce of solution of carbonate of potass. Wash and dry the precipitate as before.

To preserve lemon-juice squeeze it into a china basin, strain it through muslin to free it entirely from pulp. Put this into very dry half or quarter ounce bottles, and half a teaspoonful of sweet oil. Set them upright in a cool place, and when wanted remove the oil by dipping in a skewer wrapped round with clean cotton wool.

Rye Bread.—A correspondent of the *Times*, on the subject of rye bread, states that the peasantry of Northern Germany consume no other bread, and that they are as fine a race as any in Europe. "I think (he goes on to say) the prejudice in question most lamentable, and that anything calculated to dissipate it will be useful. The gentlefolks and peasantry of Norway are as fine a race as can be seen. They consume none but rye bread. At the Viceroy's table, or the King's table, when his Majesty is in Norway, there is plenty of wheaten bread, but, according to my recollection, rye bread likewise. The chief personage in Norway when I was there was Count Wedel. On every Sunday he kept open house at Bogstadt, with ample hospitality. I remember nothing but rye bread, except for myself and a few other foreigners, for whom wheaten bread was prepared. At one time I remained in his family for many weeks together; I never saw him, or the countess, or his children, eat any but rye bread at any of their meals. In Norway I have constantly consumed it myself. This is my testimony regarding rye bread; and, as having the welfare of the poor most deeply at heart, I lament indeed to see it opposed by prejudices so destructive of it. I am sure that few benefits of the material kind could be conferred upon them that would be greater than familiarizing them with the uses of rye bread, Indian corn, and maccaroni. The last is the most nutritive, economical, and useful form that can be given to wheaten flour. It forms the staple of the food of the peasantry and poor of Italy, with oil and a melted anchovy. I have often been compelled at wayside houses in out-of-the-way places to eat the coarser sorts, and am sure that, with a little melted dripping in which a small piece of red herring were dissolved, it would be as agreeable to the English as it is to the Italian palate, and when the corn-laws shall be finally abolished I hope there will be a great importation of the coarser sorts of it."

Method of Discovering the Presence of Turpentine in other Essential Oils.—M. Mero has determined the fact that the essential oils, generally speaking, which, when alone, will not dissolve fatty oils, acquire that property when mixed with essence (oil) of turpentine. Thus, on agitating the oil of marjoram, peppermint, lavender, sage, thyme, &c., with a fatty oil, a milky compound results if the essential oil were pure, and a transparent mixture if the same had been falsified with the oil of turpentine.

Directions for Clarifying Oil for Varnish.—Procure a copper pan, made like a common washing-copper, which will contain from fifty to eighty gallons, as occasion may require; when wanted, set it upon the boiling furnace, and fill it up with linseed-oil within five inches of the brim. Kindle a fire in the furnace underneath, and manage the fire so that the oil shall gradually, but slowly, increase in heat for the first two hours; then increase the heat to a gentle simmer, and, if there is any scum on the surface, skim it off with a copper ladle, and put the skimmings away. Let the oil boil gently for three hours longer; then introduce, by a little at a time, one quarter of an ounce of the best calcined magnesia for every gallon of oil, occasionally stirring the oil from the bottom. When the magnesia is all in, let the oil boil rather smartly for one hour; it will then be sufficient. Lay a cover over the oil to keep out the dust while the fire is drawn and extinguished by water; then uncover the oil, and leave it till next morning; and then, while it is yet hot, ladle it into the carrying-jack, or let it out through the pipe and cock; carry it away, and deposit it in either a tin or leaden cistern, for wooden vessels will not hold it; let it remain to settle for at least three months. The magnesia will absorb all the acid and mucilage from the oil, and fall to the bottom of the cistern, leaving the oil clear, transparent, and fit for use. Recollect, when the oil is taken out, not to disturb the bottoms, which are only fit for black paint.

To Discover the Presence of Quinine.—M. Stenhouse recommends, as a means of discovering the presence of quinine or cinchonine in cinchona bark, to boil a portion of the bark with weak sulphuric acid, to filter, and then precipitate the solution by a small excess of carbonate of potash; afterwards to collect the precipitate, to dry it, and then distil it with caustic potash. The product of distillation is *quinoline*, a substance easily discoverable by its odour and alkaline properties. It must, however, be kept in mind that strychnia also yields quinoline under similar treatment.

TO CORRESPONDENTS.

During the pressure of business last week, on account of an unexpectedly large sale of the *Chemical Times*, many of our subscribers received unstamped copies by mistake. Such copies will be exchanged for others on application at the office.

Lord Ashley is assured that he may rely on our co-operation.

"A Correspondent" sends us the following letter, enclosing another, which we append, from the secretary of the Pharmaceutical Society. The question at issue seems to be, whether our correspondent, having ceased to contribute to the funds of the Pharmaceutical Society, can be obliged to return the diploma. Now, we view the matter in the following light. The functions proposed to be discharged by the Pharmaceutical Society are twofold. The first is to supply a diploma, or guarantee of competence, to really competent persons; the second to supply information by the journal or otherwise. It appears to us that our correspondent, by ceasing to subscribe to the funds of the society, has forfeited all claim to any advantages derivable from the exercise of the second function; but he is no less competent as a chemist and druggist because his annual payments have lapsed, and therefore the diploma, or guarantee of competence, is as much, we take it, our correspondent's property as before. On these grounds we, on principle, counsel him not to return it except he promised to do so; but it is due to his own honour to state explicitly his grounds for contesting the point to the society, and also to pay up his fees until such time as he might have formally tendered his resignation as a member:—"Sir,—I have been a subscriber to your paper ever since its commencement as the *Pharmaceutical Times*. I am also cognizant of your kind courtesy to your readers, and I am impressed with your sound judgment on every matter you choose to handle. Under these circumstances I venture to ask your advice. In 1842 I became a member of the Pharmaceutical Society I have been so since. This year my subscription was not paid to them in time (and remains unpaid). I received circulars from Mr. Smith, the secretary, informing me of the by-law which excludes members if their subscription is not paid in May, but offering to take it then. I declined, and said I would wait. I have now received the enclosed attorney-like letter, demanding my diploma, from Mr. Smith. My object in writing this to you is to ask you if the society have the power to compel the surrender of their diploma. I really think I have paid quite sufficient to support the honour of the trade, and you will see by this letter of Smith's that there is no drawing back. Our guineas have gone from us without our having anything like an adequate return. If the journal had been in the hands of a scientific man we might have deemed it some compensation; but it is not so. I will, however, be guided by your advice, if you will kindly give it me. And if I am not trespassing too much on your valuable time, I would ask you to be good enough to write to me privately upon it.—P.S. I wonder what he means by my 'positive engagement to return the document.' I never entered into such an engagement. I have written to Mr. Smith to ask him this." "17, Bloomsbury-square, November 10, 1848.—Pharmaceutical Society of Great Britain.—Sir,—By order of the council of this society I forward to you a requisition, that you should return the diploma acknowledged to have been received by you on the of October, . You ceased to be a member of this society, incorporated by charter, by reason of your omitting to pay the annual subscription, and, as it is a duty of the council to require you to perform your positive engagement to return the document, I am instructed to request that you will not fail to pay immediate attention to this application. I am, sir, your obedient servant, George W. Smith, Secretary."

Staite's last patent concerning the electric light is not yet specified. The general superiority of Mr. Staite's process consists of developing light by electricity over that commonly pursued by chemists consists in the use of improved carbonaceous points. Mr. Staite first reduces coke to impalpable powder, makes a paste of the latter, and compresses it into mould. He next burns these compound masses for a long period at a high temperature; afterwards dips them into melted (caramelized) sugar, and burns again.

"A Glasgow Correspondent" is informed that the hydrated oxide of lead may be procured by precipitating the acetate of lead by means of potash or ammonia. The composition of Plummer's pill is as follows:—Calomel and oxysulphuret of antimony, of each two drachms; powdered guaiacum resin, half an ounce; treacle, two drachms. First rub the chloride of mercury with the oxysulphuret of antimony, afterwards with the powdered guaiacum resin and treacle until incorporated.

"Mr. Thomas Hinckling."—By the hyperchlorate of baryta we presume you mean the perchlorate of that base. It may be made as follows:—First prepare a mixture of perchlorate and bisulphate of potash, then pour some oil of vitriol into a capacious dish, and throw in by small portions at a time, stirring continually, powdered chlorate of potash until no more peroxide of chlorine is developed. This operation requires great care, for each addition of the chlorate of potash, effects a most powerful chemical action, amounting occasionally to an explosion. When all chemical action has ceased, the residue should be collected and distilled from a tubulated retort into a glass receiver. The distillate is perchloric acid, which should be accurately saturated with baryta, to form the perchlorate of that base.

"Investigator."—Theoretically, every 104 parts of metallic lead, when converted into oxide by fusion with the access of air, should yield 112 parts; practically, however, this quantity is never attained, on account of the volatility at high temperarures of the lead oxide.

"Mr. George Malcolm" is in error. There are many portions of the globe in which rock-salt and brine springs, which must derive their origin from the latter, occur in other formations besides that of the new red sandstone; indeed, they occur in rocks of almost all ages. Thus, in some parts of the United States, salt or brine springs issue from old transition slate rocks, and many copious salt springs occur in the English coal measures. The rock-salt of Cheshire and the salt springs (which are known to issue from beds of the same substance) in Worcestershire are situated in the new red sandstone belonging to the secondary rocks. In Wurtemberg, Alberti has demonstrated that rock-salt exists in the upper members of the new red sandstone series, termed Keuper and Muschelkalk. In Switzerland it exists in the lins. In the Austrian Alps, in the upper oolites. The salt deposit of Wieliczka, near Cracow, exists in the tertiary series, and at this time it is continually depositing in the inland lakes of the Crimea.

"A Practical Chemist."—Madder is the root of the Rubia tinctorum, a plant which is cultivated in the south of Europe, and the countries bordering on the Mediterranean, as a dye stuff. That which is employed in Great Britain chiefly comes from the Levant. That which is cultivated in Holland is not so good as the Turkey madder. Besides the Rubia tinctorum, the Rubia cordifolia, and R. peregrina also yield the same red colouring matter. The former grows in Siberia, the latter near the Mediterranean shores.

"Mr. Henry Reeves."—The substance dragon's blood comes from the East Indies. It is obtained from different species of trees. We believe the greater quantity of that brought from India to be furnished by the Calamus draco, although a considerable quantity is yielded by the Pterocarpus draco and Dracœna draco.

"A Snuff-taker."—We believe that there exists not a snuff into the composition of which some body besides tobacco does not enter. All the dark-coloured snuffs are artifially tinged, generally by the powdered extract of logwood; and quicklime and muriate of ammonia are added for the sake of imparting pungency. The injurious effect of these latter bodies in the mucous membrane of the nose can be more easily conceived than described.

"An Assistant."—Forty grains of good filtering paper contain, on an average, one third of a grain of ashes. Red blotting paper is made from the shreds of Turkey red cloth; hence its colour is due to madder.

"Mr. E. Applegate."—The size will be hereafter enlarged. The gentlemen indicated have promised to furnish articles. More care shall be taken in the folding of the journal.

"J. H., Shoreditch."—1. We know of no practical means. 2. Try a stream of sulphurous acid gas. 3. A varnish of thickly-boiled linseed-oil, such as printing-ink is made of, would stand better than any paint. 4. No. 5. Again try sulphurous acid. 6. Experiments would be required to determine this point.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to annual subscribers sending a Post-office order directed to Robert Palmer, or an order on some party in town, for one guinea in advance, which will ensure the journal for twelve months. Half-yearly subscriptions, 13s.; quarterly, 6s. 6d. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—November 25, 1848.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,*
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

We will discuss the two modes of representing decompositions, in order to prove how those represented by radicals are preferable to the old system of equation. Perhaps, before doing so, it will be well to append in a tabular form some of the more commonly occurring simple and compound radicals, and to offer a few remarks thereon:—

Radical.	Symbol for the Radical.
Chlorine	Cl
Iodine	I
Bromine	Br
Sulphatoxygen (radical of sulphuric acid)	SO^4
Sulphitoxygen (radical of sulphurous acid)	SO^3
Nitratoxygen (radical of nitric acid)	NO^6
Cyanogen (composed of C^2N)	Cy
Sulphocyanogen (composed of C^2NS)	H Cy S^2

By referring to the above, we see that the radical of sulphuric acid is represented by SO^4, which compound, however, has not been isolated; but this in nowise determines its non-existence, as we have sufficient data to assume that it is present in a numerous class of substances.

Sulphuric acid is generally expressed by the symbol SO^3. Why should this be, when SO^3 does not possess acid properties?

Anhydrous sulphuric acid, SO^3, condenses in solid flakes analogous to asbestos, and may be moulded by the fingers like wax. It does not redden litmus paper, unites with chloride of sodium without decomposing it, and Rosé combined it with dry ammonia, forming an exceedingly curious compound, quite distinct from the sulphate, as will be seen from the subjoined formulæ:—

Sulphate of ammonia ..... $NH^4\ SO^4$
Rosé's salt ..... $NH^3\ SO^3$

In a recently prepared cold solution of the latter neither sulphuric acid nor ammonia can be detected; consequently there is every reason to believe in the existence of the compound radical SO^4, and it will ultimately be introduced into all works on chemistry, as it facilitates and elucidates decompositions. *E.g.*:—

When hydrated sulphuric acid is added to chloride of sodium we obtain hydrochloric acid and sulphate of soda.

Old Method.

$$SO^3\ HO + Na\ Cl = (SO^3\ NaO) + HCl$$

New Method.

Hydrated sulphuric acid .... $SO^4 + H$
Chloride of sodium ..... $Na + Cl$

The decomposition in the latter case is expressed at once, for on the right hand we have H and Cl, or hydrochloric acid, and to the left SO^4 and Na, or sulphate of soda. By adopting this new system of equation we simplify chemistry, and especially the series of acids, all of which may be represented as hydrogen compounds; and, moreover, when an acid decomposes any metallic oxide its hydrogen is replaced by another metal, or, in organic chemistry, by a basic radical, such as ethyle (Ae). I will annex a few of the acids and salts to show you at a glance the superiority of the hydrogen theory of acids:—

Name.	Symbol.
Chloride of hydrogen (hydrochloric acid)	Cl + H
Chloride of sodium (common salt)	Cl + Na
Chloride of ethyle (hydrochloric ether)	Cl + Ae
Chloride of ammonium (sal ammoniac)	Cl + Am
Bromide of ethyle (light hydrobromic ether)	Br + Ae
Sulphatoxide of hydrogen (sulphuric acid)	SO^4 + H
Sulphatoxide of sodium (Glauber's salt)	SO^4 + Na
Nitratoxide of hydrogen (nitric acid)	NO^6 + H
Nitratoxide of ethyle (nitric ether)	NO^6 + Ae
Nitratoxide of ammonia (nitrate of ammonia)	No^6 + Am
Sulphide of hydrogen (hydrosulphuric acid)	S + H
Sulphide of ammonium (hydrosulphate of ammonia)	S + Am
Cyanide of hydrogen (hydrocyanic acid)	Cy + H

The above is sufficient to show the perfect analogy subsisting between the relations of the simple and compound radicals. I have told you that the hydrogen in the acid is replaced in the salt by another metal, or a basic radical-like ethyle, so that if there be one equivalent of hydrogen in the acid the salt will contain one equivalent of metal; two, a corresponding number; and when there are three they will be replaced by three of an easily reducible metal.

	Hydrogen acid.	Silver salt.
Sulphuric acid	$SO^4 + H$	$SO^4 + Ag$
Fulminic acid	$Cy^2\ O^4 + H^2$	$SO^4 + Ag^2$
Phosphoric acid.	$PO^8 + H^3$	$PO^8 + Ag^3$

Such facts furnish us with strong evidence for the view that the neutralizing effect of acids is measured by, and depends upon, the quantity of hydrogen replaceable by metals which they contain.

When the oxygen of any organic compound is removed, and its place occupied by an equivalent of sulphur, a sulphur compound of the same radical is formed, possessing properties similar to the original substance. For example,

Alcohol, $C^4\ H^6\ O^2$, gives mercaptan, $C^4\ H^6\ S^2$.

Alcohol, or hydrate of the oxide of ethyle, = Ae O + HO.

Mercaptan, or hydrosulphide of sulphide of ethyle, Ae S + HS.

In whatever mode the formula is represented we recognise the great analogy between the two compounds. The properties and chemical relations of mercaptan are also very similar to those of alcohol; in fact, mercaptan is alcohol in which the oxygen has been replaced by sulphur. It is produced when the hydrosulphide of the sulphide of potassium (HS + KS) is distilled with sulphovinate of lime (sulphate of the oxide of ethyle and lime):—

$$\underbrace{HS + KS}_{\text{Hydrosulphide of the sulphide of potassium.}} + \underbrace{C^4\ H^5\ O,\ SO^3}_{\text{Sulphovinate of lime.}} + CaO\ SO^3 = \underbrace{KO\ SO^3, CaO\ SO^3}_{\text{Sulphates of potassa and lime}} + \underbrace{C^4\ H^6\ S^2}_{\text{Mercaptan.}}.$$

When we remove from substances any of their constituent parts, there is oftentimes produced a new compound of another radical, and sometimes a new radical. *E.g.*: Bisulphide of cyanogen when heated yields bisulphide of carbon, mellon, and sulphur. Bisulphide of carbon (CS^2) is a new compound of a simple radical, carbon; and mellon is a new compound radical analogous to cyanogen in its composition and salts. This radical, discovered by Liebig, is a lemon-yellow powder, insoluble in water, alcohol, and dilute hydrochloric and sulphuric acids; soluble with decomposition in potassa and nitric acid. When mellon is submitted to a red heat it is resolved into cyanogen and nitrogen. Mellonide of potassium is the principal combination of mellon. It may be most advantageously prepared by fusing together

Forty-seven parts of ferrocyanide of potassium,
Seventeen parts of carbonate of potassa,
Twenty-two parts of sulphur.

The excess of potassium presented in the alkaline carbonate allows the formation of sulphide of iron and sulphocyanide of potassium, which do not eviscerate any of the mellonide.

[*To be continued.*]

* Dr. Scoffern's Paper on Sugar next week.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXIV.

(LECTURE LXII.)

FATS AND FIXED OILS—(*Continued*).

SECTION I.

OILS, FATS, AND SUBSTANCES WHICH OWE THEIR PROPERTIES TO THE FATTY PRINCIPLES WHICH THEY CONTAIN—(*Continued*).

SPERMACETI.

Spermaceti is a solid fatty matter obtained from the oil lodged in the enormous cavity of the head of the Physeter macrocephalus, or spermaceti whale, and of other of the Cetacea. During the life of the animal the spermaceti is held in solution by the oil; but after its death this substance separates from the latter and is deposited in the solid state.

Spermaceti contains margaric acid and oleïc acid, but no glycerine; instead of the latter substance it contains oxide of cetyle.

Cetyle is a hypothetical radical, of which the composition may be represented by the formula—

$$C^{32}\ H^{33}.$$

With one equivalent of oxygen it forms oxide of cetyle, which, in combination with the margaric and oleïc acids, constitutes pure spermaceti, or *cetine*.

On boiling cetine with an alkaline solution, the fatty acids combine with the latter, and the oxide of cetyle is liberated. At the moment of its liberation, the oxide of cetyle combines with water to hydrated oxide of cetyle. Chevreul gave the latter compound the name of *ethal* (from the first syllable of the words ether and alcohol, on account of its analogy of composition with these liquids).

According to Laurent Smith, however, it would appear that spermaceti, or, more correctly speaking, cetine, is not a compound of oxide of cetyle with the margaric and oleïc acids, but with ethalic acid, for which latter acid that chemist gives the formula—

$$C^{32}\ H^{31}\ O^3.$$

The spermaceti of commerce contains always a small proportion of a fluid oil and a yellowish principle. From these admixtures it may be purified by solution in boiling alcohol. The pure cetine crystallizes from this solution, upon cooling, in white scales of silvery lustre, and firm consistence. It feels soft and slightly unctuous to the touch. It fuses at 113° Fahrenheit. It is insoluble in water, but to a trifling extent soluble in cold, and rather readily so in boiling, alcohol. Of the latter it requires about thirteen times its own weight for solution; but on cooling the greater part of the dissolved cetine is deposited again in the form of brilliant scales. It is soluble in ether.

GAUBIUS' LINCTUS (LOHOC).

Take of Spermaceti,
Pounded gum arabic, of each 8 grms.
Sugar, 24 grammes,
Rose-water, 64 grammes.

Triturate the spermaceti in conjunction with the gum and sugar, until you find that these several ingredients are most perfectly and intimately intermixed; add a little rose-water, triturate ten minutes longer, and add gradually the rest of the water.

For potions it is preferable to substitute egg yolk for gum arabic.

SWEET ALMONDS.

Sweet almonds are the seeds of *Amygdalus vulgaris*, varietas: *dulcis*.

According to Boullay's analysis sweet almonds are composed of

Water	3.5
Skins	5
Oil	51
Albumen and caseïne	24
Liquid sugar	9
Gum	3
Vegetable tissue	4
Acid and loss	0.5
	100.0

The almond has the generic characters which belong to all emulsive seeds.

The oil which is extracted from it is very mild, and has hardly any taste or smell.

Pure oil of sweet almonds marks 38 by Gobley's elaiometer, at 54.5.

The skin of the almond contains a little fatty oil and tannin.

OIL OF SWEET ALMONDS.

The following is the best method to prepare sweet almond oil:—Separate the kernels from the stones and fragments of shells, which are usually mixed with the almonds as sold in commerce; shake the picked almonds in a coarse bag, and sift them afterwards: this operation is intended to remove a sort of scaly dust which covers the surface of the almond, and which would absorb a portion of the oil, and accordingly by so much reduce the amount of the product.

Pound the almonds now in a mortar, or, better still, grind them in a mill, and subject the pounded or ground mass to graduated pressure in a strong ticking or horse-hair bag. Filter the expressed oil.

Some prefer crushing the almonds to a paste, instead of pounding or grinding them. The oil expressed from almond paste, however, always carries away with it a portion of the parenchyma and albumen of the almonds, and requires accordingly more time to clear, and is more liable to turn rancid than that expressed from pounded or ground almonds.

The blanching of almonds (by means of boiling water) should never be resorted to by the apothecary, since the application of heat tends necessarily to increase the liability of the oil to become rancid.

Bitter almonds yield by cold pressure an oil perfectly analogous to that obtained from sweet almonds; and as the former are cheaper than the latter, and the expressed cake of the bitter almonds is, moreover, on the other hand, of greater value than that of the sweet almonds, the oil is commonly prepared from the former.

For internal use we prefer sweet almond oil to any other fixed oil, on account of its mild and agreeable taste, and feeble odour. It is given as a demulcent in doses of from 4 to 30 grammes in certain inflammatory diseases of the alimentary canal or of the respiratory organs.

OILY POTION.

Take of Gum arabic, 8 grammes.
Sugar syrup, 24 grammes.
Orange-flower-water, 4 grammes.
Common water, 125 grammes.
Sweet almond oil, 32 grammes.

Add the sweet almond oil to the potion prepared with the other ingredients.

Some formulas recommend to emulsion the oil with the gum, instead of mixing it with a ready-prepared potion; thus, for instance, the Codex gives the following formula:—

Take of Pounded gum arabic,
Sweet almond oil, of each 16 grammes.
Syrup of marshmallows, 32 grammes.
Common water, 96 grammes.
Orange-flower-water, 16 grammes.

Prepare a mucilage of the gum with a part of the water, and add to this the oil gradually and in small portions. Dilute the emulsion subsequently with the rest of the liquids.

WHITE LINCTUS.

Take of Sweet almonds, 18 grammes.
Bitter almonds, 2 grammes.
Sugar,
Sweet almond oil,
Orange-flower-water, of each 16 grammes.
Common water, 125 grammes.
Gum tragacanth in powder, 90 centigrammes.

Blanch the almonds in the usual way, and pound them subsequently in a mortar in conjunction with part of the sugar and a little water; as soon as the paste appears perfectly smooth and uniform, dilute it with the rest of the water, and strain the emulsive liquid through a cloth, with pressure. Triturate now the gum tragacanth with the rest of the sugar, and add to the mixed powder a little of the emulsion, sufficient to form a mucilage. Mix the oil with the latter by long-continued trituration, and add to the mixture gradually the rest of the emulsion. Flavour finally with the orange-flower-water.

GREEN LINCTUS.

Take of Fresh pistachio nuts, No. 14.
Syrup of violets, 32 grammes.
Sweet almond oil, 16 grammes.
Tincture of saffron, 1 gramme.
Orange-flower-water, 8 grammes.
Common water, 125 grammes.
Powder of gum tragacanth, 90 centigrammes.

F.S.A.

As it is often difficult to procure fresh pistachio nuts, sweet almonds may be substituted for them. The mixture of the violet syrup and the saffron suffices to impart to the tincture the requisite green colour.

ALMOND MILK OR EMULSION.

Take of Sweet almonds, 32 grammes.
River water, 160 grammes.
Sugar, 16 grammes.

F.S.A.

This preparation constitutes a sort of potion, which is usually given as a demulcent in one dose.

Take of Sweet almonds, 16 grammes.
Water, 1,000 grammes.

F.S.A.

Sweeten at pleasure.

This emulsion forms an agreeable demulcent drink.

AMYGDALINE PASTE.

Take of Sweet almonds, 6 grammes.
Bitter almonds, 1 gramme.
Water,
Gum arabic,
White sugar, of each 16 grammes.
Orange-flower-water,
Rose-water, of each 1 gramme.

Make an emulsion with the almonds and the water, and dissolve in it first the gum and afterwards the sugar; evaporate the mixture to the proper consistence, and add to it about the fourth part of the white of an egg, beaten up with the aromatic waters.

In the preparation of large quantities of amygdaline paste, the whites of twelve eggs should be used to every kilogramme of sugar.

CACAO.

Cacao beans are the seeds of Theobroma cacao.

The cacao beans contain a solid fatty matter, called cacao butter, a tolerably large proportion of tannin, and a crystalline principle, discovered first by Woskresensky, who gave it the name of Theobromin; this principle is analogous with caffein. It is white. Its taste is slightly bitter, and resembles that of caffein and of cacao. It is more readily and copiously soluble in boiling than in cold water, and in the latter menstruum more so than in alcohol and in ether. The composition is represented by the formula—

$$C_9 H_5 N^3 O^2.$$

It may be readily procured by digesting cacao in distilled water, and precipitating the fluid subsequently with acetate of lead. The liquid is then to be filtered off from the precipitate, and the excess of lead removed from the filtrate by means of hydrosulphuric acid. The theobromine which is left in solution in the fluid is ultimately obtained in crystals by evaporation. It is then finally purified by solution in alcohol and recrystallization.

CACAO BUTTER.

Cacao butter is prepared best in the following way:—

Cull the beans carefully to get rid of the stones and other impurities with which they may happen to be mixed; torrefy them afterwards slightly in an iron drum, to render the shells friable; break into pieces, and winnow to get rid of the shells; sift subsequently to remove the germs; grind in the mill, and pound afterwards in a heated mortar. Place the paste obtained in the water-bath, and keep it there for some time; add to it a quantity of water, about one tenth the weight of the crude cacao used. Put the paste now quickly in linen bags, and press the latter between tinned iron plates, heated in boiling water.

This process is by Josse. The product obtained by it is superior to those prepared by any other method.

To purify the cacao butter keep it melted for some time in the water-bath, and, after cooling, separate it from the dregs; place the butter now on unsized paper, exposed freely to the air; by this means the water is removed. Melt the pure butter again, and filter the melted liquid in funnels heated by steam.

MM. Henry and Guibourt recommend to let the melted butter run from the funnel tube directly into medicine bottles, where it will then solidify on cooling. In this manner the butter is protected from contact with the air, and may be kept a length of time without suffering alteration.

Pure cacao butter is composed of oleïne and stearine. It fuses at 84.2 Fahrenheit. At the common temperature it is solid, white, inclining slightly to yellow, and has a mild flavour and agreeable smell.

PILLS OF CACAO BUTTER.

Take of Cacao butter, 8 grammes.
Powder of marshmallows, 1 gramme.

Make into pills of 20 centigrammes each.

PASTILS OF CACAO BUTTER.

Take of Cacao butter, 12 grammes.
Sugar, 88 grammes.
Gum tragacanth, 1½ gramme.
Rose-water, 12 grammes.

Make a mucilage of the gum with the rose-water; triturate the butter in conjunction with the sugar, and, with the aid of the mucilage, make into pastils of 1 gramme each.

VARAKA OF THE INDIES.

Take of Pure torrefied cacao, 250 grammes.
Sugar, 720 grammes.
Cinnamon, 30 grammes.
Vanilla, 8 grammes.
Ambergris, 60 centigrammes.
Musk, 30 centigrammes.

Pound the cacao (cold), add the vanilla (cut and bruised), together with a little sugar, and afterwards successively the cinnamon, musk, and ambergris, and the rest of the sugar, keeping pounding all the while. Pass the powder through a hair sieve.

TRONCHIN'S PECTORAL CREAM.

Take of Cacao butter,
Syrup of maidenhair,
" of tolu balsam, of each 32 grammes.
Sugar, 16 grammes.

Grate the butter, and triturate it subsequently together with the sugar; incorporate the triturated mass with the syrups.

SUPPOSITORIES OF CACAO BUTTER.

Melt the requisite quantity of cacao butter at a gentle heat, and pour the melted mass into conically-shaped paper moulds.

Section II.

SUBSTANCES IN WHICH THE FATTY MATTER IS ASSOCIATED WITH SOME ACTIVE PRINCIPLE.

This series comprises:—

The seeds of Ricinus communis,

The seeds of Croton tiglium,
" Euphorbia lathyris,
Cod-liver oil.

RICINUS SEEDS.

The seeds of Ricinus communis contain an oil which is very remarkable for its chemical properties: this oil is known in England under the name of castor oil. It is white and viscous, and has a feeble and disagreeable taste and smell. It is soluble in all proportions in alcohol of 95° C. Alcohol of 90° C. dissolves of it only 3-5ths of its own weight. Upon saponification it yields, according to the observations of Bussy and Lecanu, three different acids, viz., ricinic acid, elaïodic acid, and margaritic acid: the two former of these acids are remarkable for their excessive acridity. The ricinic acid is solid, the elaïodic acid liquid. Both are exceedingly soluble in alcohol and in ether. Several of the salts which they form with bases are soluble in alcohol.

We are as yet almost perfectly in the dark as regards the chemical composition of castor oil. Some persons fancy that the purgative property is inherent in the oil, contending that, as the oil differs in its chemical characters from all other fats and oils, so it may also differ from them in its medicinal properties. The purgative action of the oil, however, is exceedingly feeble as compared with that of the seeds: an emulsion made with one or two ricinus seeds purges violently. A few years since I had extracted from castor oil, by a long process which did not admit of great exactness, a soft, resinous matter, apparently analogous to the resin of the oil of Euphorbia lathyris: this matter was, however, evidently a complex product. M.Boutron, some years ago, found in castor oil a species of stearine. I have since succeeded to extract (with the aid of repeated solution in alcohol) from a deposit formed by castor oil a solid, white, slightly pitchy substance, which fuses only at a temperature above 212° Fahrenheit. From the small quantity of these products I have been unable to study them more minutely; yet the simple fact of their having been produced from castor oil suffices to show that this oil must be a mixture of several different substances.

PREPARATION OF CASTOR OIL.

Pick the ricinus seeds carefully, to get rid of all foreign bodies with which they may happen to be mixed; grind the seeds in a mill, put the pasty powder obtained into a ticking-bag, and subject to the action of the press, taking care to proceed gently and gradually, as the oil is very viscous, and can run off only slowly. Filter the product (which is by no means transparent) through paper, exposing the filter to the heat of the stove, which will diminish the viscosity of the oil, and thus enable it to pass through the filter.

Castor oil is given as a mild purgative in doses of fifteen to sixty grammes. The best way to administer it is in a little mutton or chicken broth, or beef tea, from which the fat has been skimmed off. It is also sometimes given in emulsion.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

J. C. NESBIT, ESQ., F.G.S., &c., ON A NEW METHOD FOR THE QUANTITATIVE DETERMINATION OF NITRIC ACID.

[*Communicated by the Author.*]

It has long been felt as a great evil by chemical analysts that no good, efficient, and easy plan for the determination of nitric acid and some of the compounds of nitrogen has yet been made known, and that, consequently, the analysis of these substances is a matter of considerable difficulty and trouble. Any attempt towards the solution of this problem will, it is to be hoped, receive a favourable consideration from many who have experienced the need of an easier plan.

The method, which is the subject of this paper, depends upon the possibility of converting, by means of nascent hydrogen, an equivalent of nitric acid, or of any nitrate or other body containing an equivalent of nitrogen, into an equivalent of ammonia,—a substance of very easy quantitative determination.

It was long ago observed that, when dilute nitric acid is allowed to act upon tin filings, ammonia may be detected in the solution of the metal. The same was afterwards observed with iron. Kuhlman has still further generalized these observations by proving "that all the metals capable of decomposing water give a certain quantity of ammonia when they are placed in contact with weak nitric acid."

More recently, Kuhlman has published a number of experiments, showing, under various circumstances, the production of ammonia by nascent hydrogen in the presence of one or other of the nitrates.

Thus he shows that, when dilute sulphuric or hydrochloric acid in contact with iron or zinc is in the act of evolving hydrogen, the addition of a nitrate causes the evolution of gas to cease for awhile, and that afterwards ammonia may be found in the solution.

It is evident from this that the nascent hydrogen unites with the oxygen of the nitric acid to produce water, and also with the nitrogen to produce ammonia. For this purpose 8 equivs. of hydrogen are required to convert 1 equiv. of nitric acid, NO^6 H, into 6 equivs. of water, 6HO, and 1 of ammonia, NH^3, or, with the addition of 1 atom of water, NH^4 O, oxide of ammonium.

The experiments of Kuhlman, which are all qualitative, do not appear to have been carried further than was necessary to illustrate his views of nitrification; and they do not, therefore, show the extent to which this conversion is carried, and whether the whole of the nitrogen can be made to assume the form of ammonia.

A number of experiments have in consequence been instituted in our laboratory, which have proved that, with proper precautions, the whole of the nitrogen in the nitrates and in nitric acid may easily be made to assume the form of ammonia, and thus be rendered easy of determination.

If ten grains of a salt, such as nitrate of potash, be taken for analysis, about 200 or 300 grains of thin, clear fragments of zinc are put into a small flask, to which a portion of water is added. From half an ounce to three quarters of an ounce of hydrochloric acid, sp. gr. 1.17, must be poured out into a small measure, and about one tenth part added to the zinc and water. When effervescence has fairly commenced a portion of the nitrate, previously dissolved in a small quantity of water, is added to the mixture. The temperature of the whole must, if necessary, be kept low, by placing the vessel in cold water. After a short period a little more acid is added, and then a little nitrate, until all the solution of the nitrate with the washings is poured in, and about one fourth of the acid is left. Care should be taken that for the first hour the effervescence is slow. When the whole of the solution of the nitrate is poured in, the remainder of the acid must be added from time to time, and the whole left until effervescence ceases. The liquid is then carefully separated from the undissolved zinc, which is well washed with the smallest quantity of water, and the whole distilled with a proper quantity of hydrate of lime, or, occasionally, a little potash; the ammonia being collected in a proper condenser, similar to Liebig's five-bulb apparatus. The great danger to be avoided consists in allowing the hydrogen to be liberated too rapidly, by which means so much heat is generated as to cause a portion of the nitrogen to escape in the form of binoxide of nitrogen. It is useless to point out that the hydrochloric acid must contain no salt of ammonia.

The ammonia is determined in our laboratories by a method similar to that of Dr. Ure, which admits of considerable exactness, viz., by the use of a solution of litmus and a neutralizing acid of known constitution. The dilute sulphuric acid used has a sp. gr. of about 1.0327; 1,000 grain measures of which contain exactly an equivalent in grains of sulphuric acid. This quantity, therefore, will exactly neutralize an equivalent of any alkali.

The acid can always be easily kept at the proper strength by means of two hydrostatic bulbs made, the one to float, and the other to sink, in the acid of proper specific gravity.

A graduated tube is filled with the acid, a small quantity of a solution of litmus is poured into a good-sized evaporating-dish, and then a portion of the ammonia water from the receiver. The acid is cautiously added until the mixture becomes red, more ammonia is added until it turns blue, then a little more acid; and, lastly, the receiver is rinsed out, and the acid carefully dropped in until the blue colour of the mixture just changes to red, when the number of drops of acid that have been used must be read off. The number of drops of acid, multiplied by the equivalent of ammonia and divided by 1,000, will give the amount of ammonia present in the body under examination. In the case of a nitrate being employed the number of drops of acid, multiplied by the equivalent of the nitrate under examination and divided by 1,000, will give the amount of the pure nitrate used. A similar calculation is made for nitric acid.

The following experiments will demonstrate the accuracy of this method for the determination of the nitrates, and its applicability to numerous difficult cases. For most of the results I am indebted to those of my pupils whose names are attached to their respective analyses:—

TABLE OF EXPERIMENTS ON THE COMPLETE CONVERSION OF NITRIC ACID INTO AMMONIA.

	Substance taken.	Drops of Acid to Neutralize the produced Ammonia.	Substance by Calculation.	Nitric Acid by Theory.	Nitric Acid by Calculation from Experiment.	
1	15 grains pure nitre	148	14.99	8.01	8.01	J. C. Nesbit.
2	15 " ditto	148	14.99	8.01	8.01	J. Bailey.
3	8 " ditto	80	8.19	4.27	4.33	J. Gater.
4	15 " ditto	148	14.99	8.01	8.01	J. Bailey.
5	5 " ditto	49	4.96	2.67	2.65	ditto.
6	5 " ditto	49	4.96	2.67	2.65	J. Gater.
7	15 " ditto	148	14.99	8.01	8.01	ditto.
8	5 " ditto	50	5.06	2.67	2.70	E. Lane.
9	15 " ditto	148	14.99	8.01	8.01	J. Bailey.
10	5 " ditto	49	4.96	2.67	2.65	ditto.
11	10 " nitre and 95 " salt	99	10.02	5.34	5.36	ditto.
12	15 " nitre and 95 " salt	10	15.19	8.01	8.12	ditto.
13	5 " nit. baryta	38	4.97	2.06	2.05	J. Gater.
14	5 " nitre	49	4.96	2.67	2.65	ditto.
15	5 " nit. lead	30	4.97	1.63	1.62	ditto.
16	5 " nit. baryta	38	4.97	2.06	2.05	J. Blyth.

Experiments have been instituted with some other compounds of nitrogen, but want of leisure has prevented the completion of the investigation.

With the yellow prussiate of potash not a trace of ammonia was found, but there was a small quantity in a specimen of the red prussiate, for whose purity, however, I dare not vouch.

Some experiments have also been made with vegetable alkalis; and I apprehend that eventually, by the employment of nascent hydrogen, a much greater knowledge of the intimate constitution of some organic bodies will be obtained.

Caffeine and quinine, when subjected to this process, furnished ammonia; and in one experiment with urea one half of the nitrogen was liberated in the form of ammonia, whilst the other doubtless remained as a cyanogen compound.

I have had no opportunity of trying this process with the nitrites, hyponitrates, &c., but I have no doubt that it will serve as an easy method for their analysis.

A CORRESPONDENT ON THE MANUFACTURE OF POTATO STARCH.*

As the manufacture of potato starch has become a most important branch of manufacture, it may be interesting and useful to many of your subscribers to know the method pursued. If, therefore, the following brief account prove in your estimation of any value, you may cause it to appear in your journal. As, however, I am unaccustomed to writing, I should not wish my name appended to any thing I may forward for your consideration. The process is this:—The potatoes after being well washed are reduced to pap by a cylinder grater, making about 500 to 600 revolutions per minute, and the grated matter washed upon a wire sieve (No. 36). This operation separates the fibrous from the starchy part of the potato. The latter is now repeatedly washed with clear water until quite white and pure. It sometimes happens that numerous stones accompany the potatoes, and occasionally they appear so like the potato that except from the weight it is impossible to distinguish them. The following mode of effecting their separation I have found effectual and of easy execution:—After the potatoes are washed let them be thrown into a solution of common salt and water, sufficiently strong to cause the potatoes to swim on the surface. All the stones, being of a greater specific gravity than the potato, will sink to the bottom, and thus a serious cause of expense and annoyance will be avoided.

* As our correspondent desires it we will not print his name; meantime let us assure him that we prefer practical knowledge to elegance of composition.

FOREIGN SCIENTIFIC INTELLIGENCE.

PARIS ACADEMY OF SCIENCES.—Nov. 20.

M. Regnault presented a communication from M. E. St. Evre on some new derivations from iodoform. When a current of cyanogen is passed into an alcoholic solution of iodoform, the liquor rises in temperature, and then assumes a violet tint, more or less decided. When left to rest it soon deposits prismatic crystals of a golden-yellow colour, grouped in such a manner as to present the appearance of a vine leaf. On carefully washing the mass with dilute cold alcohol two different substances are obtained, endowed with a high degree of metallic lustre, the one of a violet colour, the other of a golden-green colour. The first, submitted to analysis, presented the composition of cyanized iodoform, and corresponded to the formula—

$$C^4 H^2 I^4, C^4 Az^2 = C^8 H^2 I^4 Az^2.$$

It contains in round numbers 87 per cent. of iodine, whilst iodoform contains 97.

The second substance contains still less iodine. Besides, these two substances, as well as iodoform itself, submitted to different reagents, such as fuming nitric acid, the alcoholic solution of ammonia, and hydrosulphate of ammonia, yielded peculiar products, which M. St. Evre is at present investigating, the results of which investigation he will submit to the Academy.

BERLIN ACADEMY OF SCIENCES.

ON THE CHEMICAL COMPOSITION OF MAGNETIC PYRITES. BY M. G. ROSE.

In this communication M. Rose seeks to prove that the magnetic pyrites constitutes a kind of itself, the chemical composition of which is represented by the formula—

$$\dot{Fe}\ {}^{5}\dddot{\overline{Fe}};$$

and that neither the magnetic pyrites of Barèges, of which the chemical composition, according to Berzelius, is represented by the formula—

$$Fe\ {}^{9}\dddot{\overline{Fe}},$$

nor that of Bodennais, which, according to M. Schaffgotoch, is represented by the following formula—

$$\dot{Fe}\ {}^{9}\dddot{\overline{Fe}},$$

can be separated from the other magnetic pyrites.

M. Rose refutes also an assertion of M. Breithaupt, supported by MM. Frankenheim, De Kobell, and Rammelsberg, viz., that the magnetic pyrites is a simple sulphuret of iron, Fe, because that it presents the same form as the simple sulphurets, arseniurets, and antimoniurets of the metals; for the magnetic pyrites leaves by solution in hydrochloric acid a residuum of sulphur which cannot be considered as being a mixture, since it cannot be extracted by sulphuret of carbon, and because that a polished surface of magnetic pyrites does not offer the slightest inequality. The simple sulphuret of iron is a compound entirely different from magnetic pyrites, inasmuch as it is never magnetic, and has a specific gravity much less than bisulphuret of iron, Fe, although all the lower degrees of sulphuration have a greater specific weight than the higher. The magnetic pyrites has, indeed, a specific gravity of 4.62, whilst the bisulphuret of iron in the iron pyrites has a specific gravity of 5.03, and the Speerkiese a specific gravity of 4.86. This low specific gravity of magnetic pyrites shows not only that it possesses a degree of sulphuration different from that of the simple sulphuret of iron, but more, that it is a combination of two different degrees of sulphuration.

The specific weight of the simple sulphuret of iron artificially prepared is, according to M. Rose, 4.73, that is to say, always greater than that of the magnetic pyrites, but lower than that of iron pyrites, which simply arises from the porosity of the substance employed.

REVIEWS.

DR. BILLING ON CHOLERA.*

Of the various publications of many forms which the appearance of the cholera amongst us has called into existence, there are very few to which we have been enabled to award a tribute of praise. They have been, in short, little better, with few exceptions, than simply records of cases—an assemblage of incongruous facts—without the shadow of philosophical arrangement, and with few practical deductions beyond mere generalities. True it is that the statistics of the disease have determined the fact that the poor, the intemperate, the ill-clad and ill-fed, have been most predisposed to the disease; but here there is nothing definite; the proximate cause of the cholera is as much obscure as ever. Again, the important facts have been educed that the cholera is not contagious, and that there is a certain family idiosynocrasy predisposing to the disease, inasmuch as the children of those who died of the cholera in the year 1832 have been found (at least in some parts of the world) to have been the first to succumb on the present occasion. But in advance of these mere generalities nothing positively has been made out, no consistent theory even of the pathology of the disease offered, far less any rational mode of treatment or code of diet laid down.

It would be somewhat amusing to collate all the official regulations from Colleges of Physicians and boards of health which have appeared on the subject of cholera from time to time. It would not require an Esculapius *redevivus* to affirm that all these codes from so many learned boards failed to embrace one general principle. To say nothing about the discrepancies of medical treatment, which are somewhat beyond our province, let us pass on to another subject which is very interesting to every body, namely, the important one of dietetics. What, then, would have been the fate of him who, in obedience to the aggregate wisdom of all the medical associations touching upon dietetics in connection with cholera, should have been implicitly guided by the same? We say his fate would be sealed—he must have starved; every article of food would have been found placed by some one of the numerous boards on the proscribed list.

A certain party of peculiar fame tells what to eat, drink, and avoid; the cholera boards have not been half so sensible in the aggregate, for we have seen that every thing in turn came under the ban.

Dr. Billing's pamphlet we emphatically exempt from the animadversion passed by us on the general medical literature appertaining to the cholera. This author, at least, has the merit of communicating the definite proposition—that the nature of cholera has been entirely misunderstood—that it is a fever, an exaggeration of intermittent fever, of so grave a type that but few patients experience the second or hot febrile stage. Admit this proposition, and it follows that the medical treatment hitherto pursued has been, up to the present period, radically wrong. It has either consisted of such inanities as warm tea, spirit, wine and water, or moderately strong spirituous drinks; or else, with more boldness than reason, heroic doses of mercury, alcohol, or essential oils; or the still more heroic remedy of saline transfusion has been had recourse to,—with what success let the records of medical practice tell!

But it is time that our author should appear:—

"Ague," he remarks, "is a kind of fever, so is smallpox; the cold shivering produced by internal inflammation is a febrile state. How different is the first accession of these diseases to what occurs afterwards; yet not more unlike than the first cold stage of cholera to the second or febrile state, which at first was not recognised, because so many died in the previous cold stage; and even in those cases where death did not occur until the febrile heat commenced the medical attendant, being generally a novice in this disease, supposed that this (in reality febrile) heat was a beneficial result of the stimulants he had administered.

"The cold stage of what is called 'fever and ague' is as like cholera as may be,—cold surface, shrivelled skin of hands, livid face, crampy pains in the limbs, pain in the stomach, headache, faintness, nausea or vomiting, and sometimes diarrhœa, in which case, of course, little or no urine is passed.

"At the accession of smallpox the patient is violently sick, with shivering, and pains in the stomach, back, head, and limbs.

"A patient with suppurative inflammation of some internal organ—the liver, for instance—will become pale and cold, the hands and feet cold as ice; his teeth will chatter, and the whole frame shiver; he will also have the pains in the head and back, and faintness. In such cases as the latter the medical man, having previously known the existence of the inflammation, which has arrived at such a height as to produce these symptoms, does not attempt to relieve the patient by hot brandy and water, but rather strikes at the root of the disease—the inflammation—by

* On the Treatment of Asiatic Cholera. By Archibald Billing, M.D., A.M., F.R.S., author of "First Principles of Medicine."

what are called fever medicines,—antimony and salines, with leeches, &c.

"When the shivering, sickness, and pains preliminary to smallpox commence, will the practitioner, if he be aware of the nature of the case, give hot brandy and water? Will he not, on the contrary, try to mitigate, by fever medicines, the feverish symptoms which he knows will supervene?

"In the cold stage of ague it is well ascertained that nothing cuts short the shivering, and other miserable sensations, so effectually as an emetic, and that it does so without the aid of any artificial external heat.

"Thus we see that, when medical men are thoroughly acquainted with a disease, they follow in many instances that practice which is called indirect and is the most efficacious. Such indirect treatment I know to be the most successful in cholera, the remedy for this disease being:—

"Water, half a pint.

"Tartar emetic, 2 grains.

"Sulphate of magnesia, half an ounce. Mix.

"The dose is, for an adult (from fifteen years upwards), a tablespoonful every half hour; for a child of a year and a half or two years, a teaspoonful; and for the intermediate years a proportionate dose.

"External heat is useless. I have found the attendants scalding their hands in applying flannel wrung out of hot water, bags of hot bran, and other fomentations, without effect: these I have always put aside, and, generally, by the time the patients had taken the third dose (if not before), they have described a sensation of warmth creeping over them. The first or second dose usually begins to allay the nausea and diarrhœa.

"I am not so absurd as to assert that this treatment is infallible, there being of all diseases, as scarlatina, smallpox, jungle-fever, cholera, &c., different degrees; from that which kills in three or four hours to that which never confines the patient to bed: one individual will be so slightly attacked as to be able to walk about during the whole course; another dangerously, but still within the reach of medical skill; a third mortally,—the dose of the morbid poison of the epidemic imbibed by the patient being so deleterious that no human aid can avail, any more than if a cannon-shot had passed through his body; the violence of the attack resembling the severe epidemic fevers of hot climates, where soldiers have been known to drop down on parade and die in a few hours.

"Cholera patients should be allowed to drink freely of quite cold water; it is the only beverage agreeable to them, and is useful in relieving the sickness and other symptoms. As soon as the urgent symptoms are checked, it is useful to give five grains of calomel, because the liver suffers similarly to what it does in ague; but, if the calomel be taken before the vomiting is stopped, it may, of course, be lost. Bisulphate of quinine, also, should be administered from the first day, analogously with ague,—a grain or more every fourth hour, and as long as the skin continues dry, and warmer than natural, as alluded to above; half a dose of the fever-mixture should also be given each time with the quinine.

"The diet should be nutritious, but light, as the tone of the stomach is greatly diminished; at first nothing is better than milk mixed with water, arrowroot, gruel, &c., given cold, until the patient's own sensations make him prefer them warm, which is evidence of a return to a more healthy state; in this respect the patient's own wishes must be attended to.

"Dry friction seems to be the only useful external application.

"When the fever-medicine cannot be quickly obtained, it is well to be acquainted with a ready substitute. The following will be found to have much influence, though it certainly is not so efficacious as to allow us to dispense with the mixture, if it can possibly be procured:—

"Half a pint of water.

"A large tablespoonful of common table salt.

"A large tablespoonful of flour of mustard. Mixed.

"The doses the same as of the former.

"Mustard is a well-known emetic; but it is not because it, or tartar emetic, or ipecacuan, or sulphate of zinc, &c., in large doses, produce vomiting, that they give relief, but because the emetic substances and salines, in divided doses, have an effect on the nerves of the primæ viæ that counteracts the effects of the epidemic poison which produces the phenomena of cholera, ague, and other febrile states."

Dr. Billing's strictures on the sapient manifesto of the non-medical Board of Health are most just:—

"The 'sal volatile,' recommended in the manifesto of the Board of Health, is not hurtful as to the medicine itself, but inefficient; and the 'hot water,' ordered to be given with it, is positively injurious. The next thing there recommended is 'hot brandy and water,' which is also injurious; as must be known by every person, medical or not, hot brandy and water is inconsistent with fever medicines in feverish disease. If the patient does not die in the cold stage the quantity of brandy in his inside will add to the fever when he arrives at the warm stage; and practitioners who formerly witnessed the cholera will recollect having sometimes seen a patient begin to get warm during such treatment, as if benefited by it; whereas this incipient warmth indicated the commencement of the second stage of the disease, and not relief from the disease, for the patient precisely at that period died, to the disappointment of all around him.

"It would be difficult for any person unacquainted with the phenomena of 'fever and ague' properly to understand this subject.

"One of the instructions of the board is, 'in a word, to do everything practicable to procure a warm general perspiration until the arrival of the medical attendant.' Did the writer of this ever see cholera? Can any human means procure a warm general 'perspiration'? The first change, whether beneficial or otherwise, must be into a gradual restoration of dry warmth, not perspiration, which, as shown above, caused many to be deceived as to the operation of stimulants. The other directions of the board, which are not incorrect, are hackneyed truisms: 'to keep the feet dry, the chambers ventilated, not to drink to intoxication, to wear flannel next the skin in damp, cold weather.' There is also a caution against 'the use of cold purgative medicines, except under medical direction,' as if the English were in the habit of using 'drastic purgatives of all kinds, senna, colocynth, glauber salts, &c.,' as part of their diet. Then there is the common fallacy of confounding *post hoc* with *propter hoc*, when one event follows another, assuming the former to be the cause of the latter, where there was merely precedence of time. For instance, cholera has occurred after a hearty meal, wherefore strong men, sailors and others, with good appetites, after working hard, must go to bed supperless, for fear of the cholera!

"But worse still, war is declared against vegetables and fruit, a most useful and healthful part of our diet, which physiologists show, from the formation of our teeth, we were intended to consume, if it were not enough for our guidance that a bounteous Providence has given them to us as a useful admixture with animal food for the preservation of our health. But because some poor creatures, who could not afford better diet, had fed upon 'plums and sour beer' previously to being attacked with cholera, 'fruits of all kinds, though ripe, and even cooked, and whether dried or preserved,' are interdicted, as well as 'green vegetables, whether cooked or not.' Whereas, on the contrary, good vegetables and ripe fruit, by preserving a healthy state of the blood and secretions, are calculated to give strength to resist an epidemic influence. 'Pickles,' too, are forbidden, though the antiseptic properties of the vinegar and spices used in their composition are calculated to prevent, not promote, cholera.

"There is one paragraph still requiring comment, as it contains a libel on human nature, implied by the statement that the opinion of cholera being contagious 'leads to the neglect and abandonment of the sick.' I must say that this assertion is totally inconsistent with my experience; for in an extensive field of observation, for nearly forty years, in hospital, dispensary, and private practice, as pupil, professor, and physician, from the palace of the rich to the hovel of the poor, I have always had great difficulty in restraining relations, friends, and attendants from unnecessary exposure of themselves to danger, in fevers, and other infectious diseases, and cannot recollect a solitary instance of the 'neglect' alluded to."

Although the proposition that cholera is only a modification of ague may appear startling at first, something altogether at variance with our preconceived opinions and prejudices, a conviction of its truth or error is only to be attained by a strict analysis of facts:—

"Upon the analogy between cholera and ague," writes the author, "I would address a few words to men of practical experience. What is called 'the fever,' so well known in India, beginning with chills and shivering (rigors), &c., followed by intense heat (after which, in favourable cases, there is perspiration, with relief of symptoms), pursues occasionally a different course; for, as we also see here in common ague, the sweat does not come on, but the skin remains hot, in a state of continued or remittent fever. Who that has seen much of the cholera does not recollect some cases with this routine? Again, 'the fever' of India, when it goes through the ague stages, does not, like our agues, continue for weeks; a second, or at most a third, paroxysm is usually fatal in the severe cases which the physician cannot check. Who has not seen patients die in cholera after they had become quite hot, that fever-heat exciting fallacious hopes? There is an epidemic, the 'Bombay fever,' on record, which is said to have destroyed the patients in the cold stage; and it was inferred that, had the patient lived, the hot stage would have come on. Who will decide now whether that was cholera or ague, or which is which? for, though called fever, the description agrees with cholera. Whoever has had much experience in ague has seen all the modifications of cholera; the cold stage, with convulsions (spasms)—spasmodic cholera; ague, with nausea and diarrhœa, and, of course, little or no urine—the purging cholera; ague, with livid blueness of the skin, and shrivelled fingers, like a drowned person—blue cholera; ague, passing into continued fever—a common termination of cholera, &c. &c.

"One of the most successful modes of treating ague is to give an emetic in the cold stage, followed up, of course, in the intervals by bark, or other tonics, with calomel, purgatives, &c., *pro re natâ*. I have frequently shown my clinical pupils that bleeding in the cold stage is perfectly safe, and analogous to an emetic as to efficacy; but as it is not often quite necessary, and there is a feeling against it, I have not frequently resorted to it, as the emetic answers the purpose; but content myself with bleeding the patient, by leeches or otherwise, when requisite, between the paroxysms. It is pretty well known how valuable an adjunct bleeding has been considered in cases of cholera; but the evidence is complicated, from the variety of treatment which has been adopted in conjunction with the bleeding, and I do not resort to it.

"It would be quite beyond the limits and scope of this essay to enter further into the description of cholera; but in Dr. James Johnson's 'Med. Chirur. Review,' April, 1832, will be found ample valuable information on the subject. At p. 627 there is a note by the editor especially worthy of notice, showing that the gruel or rice-water evacuations which constantly occur are not specific, but merely the result of all the bile and fæces which had been in the intestines

being carried away; or, as he says, 'ex nihilo nihil fit:' and I may add that, so far from a 'discharge of bile completing cure,' the discharge of bile is merely the ordinary event, evincing remission of the disease, or convalescence; and a renewed aguish paroxysm of cholera would soon wash that away too. This clear-sighted and experienced physician also inculcates the use of sulphate of quinine, as I have done on principle.

"In fine, I may repeat, that I consider cholera an essentially febrile disease, whether it assume the intermittent, remittent, or continued form; that it is not a new disease, but the same described by Sydenham in 1669, and subsequently by Frank—the same which occurs in Madras, Bengal, Italy, Russia, England, and elsewhere; that when I, as above, use Sydenham's terms, 'fresh type' and 'new epidemic,' I do so not as implying a new disease, but, as he does, a modified form of a disease, according to the 'constitution of the epidemic in the year in which it occurs;' just as he speaks of the great peculiarities assumed by the identical disease smallpox at different periods."

When we come to examine the circumstances which are attendant upon cholera at this time in London, with a view of judging of the correctness of our author's proposition that cholera is but ague modified, we discover most powerful collateral testimony in his favour. This is a subject, however, which is beyond the province of a chemical journal to expatiate upon.

To have placed the disease in the category of those which most probably depend upon miasmatic emanations brought it at once within the sphere of chemical comment. To our minds Dr. Billing has gone so far towards establishing his case that were we attacked with cholera we would desire to be treated in accordance with the theory laid down in the pamphlet before us.

NOAD'S CHEMICAL ANALYSIS.*

It affords a most pleasing testimony to the advance of modern chemistry that treatises which are designed to teach the manipulation and analytical part of that science have been lately so well received. Within the last few weeks two recent treatises on chemical analysis have been noticed in our pages, not as rivals contending for supremacy in a narrow sphere, but as rivals only in the wide paths of honourable ambition. It is now our pleasing duty to notice in terms of commendation a third, whose sphere of action is still more widely cast than either of the two former, being intended not so much for the profound chemical community as for the *people*. We say *intended*, for the author in his preface disclaims any intention on his part to enter the arena of scientific literature as the rivals of such authors as Rose and Fresenius, and explains virtually that which we have already intimated in other words, viz., that his treatise was intended *for the people*. In point of fact, Noad's treatise on analytical chemistry is an addition to the chemical treatise originally published in the "Library of Useful Knowledge"—the progress of chemistry amongst the masses having demonstrated the impossibility of doing justice to that science by the old system of mere book theories and dogmatic expositions. The preparation of this volume on chemical analysis was judiciously consigned to Mr. Noad, and the manner in which he has acquitted himself of the task proves that it could not have been delegated to abler hands.

The whole work bears the impress of sound chemical acquirements and assiduous care; moreover, the book is pervaded by a pleasing elegance of expression which enhances its value in a literary point of view. Previously to the well understanding of a chemical reaction it is absolutely necessary that a clear idea be acquired of the doctrine of chemical equivalents. This involves, almost of necessity, an acquaintance with the use of chemical symbols, a subject to the consideration of which the author devotes an instructive chapter:—

"Symbols afford a means of exhibiting in a concise and comprehensible form the composition of a compound; the mode in which its elements may be supposed to be arranged; and the changes which occur in its constitution by the substitution of one element for another. We will take the reaction between nitrate of baryta and sulphate of soda, which we have just been considering, by way of illustrating the application of these symbols, and the great advantages attending their use. This reaction would be written thus, in the form of an equation:—

$$BaO,NO^5 + NaO,SO^3 = BaO,SO^3 + NaO,NO^5.$$

"Here we have a most comprehensive view not only of the whole reaction, but likewise of the composition of the different compounds therein concerned. The collocation of letters BaO, NO^5 shows at once that nitrate of baryta is composed of nitric acid and baryta; it shows further that baryta is a compound of barium and oxygen, and nitric acid a compound of nitrogen and oxygen, that in baryta one equivalent of barium is combined with one equivalent of oxygen, and that in nitric acid one equivalent of nitrogen is combined with five equivalents of oxygen; but the formula has a still more significant meaning. BaO, NO^5 expresses, not an indefinite quantity of nitrate of baryta, but 130.64 parts by weight of that salt. The equivalent number of a compound is, as we have stated above, the sum of the equivalent numbers of its constituents. The equivalent number of barium will be found to be 68.64; that of oxygen, 8; and that of nitrogen, 14. BaO stands, then, for 76.64 parts by weight of baryta (68.64 + 8), and NO^5 stands for 54 parts by weight of nitric acid (14 + (8 × 5); BaO, NO^5 consequently represents 134.64 parts by weight of nitrate of baryta. The same observations apply to the collocation of letters NaO, SO^3; they express not only the construction of the salt sulphate of soda, and the composition of its constituents, but they signify 70.97 parts by weight of sulphate of soda. These are the salts which react on each other, and they are therefore placed on one side of the equation, with the sign + between them; on the other side of the equation we have the results of the decomposition, viz., (BaO, SO^3) (116.64 parts by weight of sulphate of baryta) and NaO, NO^5 (84.97 parts by weight of nitrate of soda); but 130.64 + 70.97 = 201.61; and 116.64 + 84.97 = 201.61; both sides of the equation agree, and the decomposition is therefore complete.

"In writing the formula for nitric acid, it will be observed that, in order to express the fact that it contains five equivalents of oxygen, a small 5 is placed after the O; now, whenever a figure is seen in this situation, it is always to be understood as affecting that element only after which it is placed; for example, $Fe^2 O^3$ means a compound of two equivalents of iron and three equivalents of oxygen: $S^2 O^2$ a compound of two equivalents of sulphur and two equivalents of oxygen; when, however, a large figure is placed before a collocation of letters, it affects the whole compound expressed by those letters: thus $3NO^5$ means three equivalents of nitric acid; $3Fe^2 O^3$ represents three equivalents of sesquioxide of iron; and $3S^2O^2$, three equivalents of hyposulphurous acid. When formulæ representing a reaction are thrown into the form of an equation, certain other signs are sometimes necessary. For example, when terchloride of gold and protosulphate of iron, both in solution, are brought into contact in certain proportions, the whole of the gold is precipitated in the metallic form. The reaction is concisely expressed thus:—

$$Au\,Cl^3 + 6\,(FeO,SO^3) = 2\,(Fe^2\,O^3, 3SO^3) + Fe^2\,Cl^3 + Au$$

one equivalent of terchloride of gold, and six equivalents of protosulphate of iron, give rise to two equivalents of persulphate of iron, one of sesquichloride of iron, and one of metallic gold. Now, here, as six equivalents of protosulphate of iron are required, the entire formula of that salt is placed within brackets, the figure 6 being prefixed; had the brackets been omitted, the formula would only have been affected by the 6 as far as the comma, and it would have been read six equivalents of protoxide of iron, and one equivalent of sulphuric acid. Again, one of the products of this reaction is two equivalents of persulphate of iron; the whole formula of persulphate of iron is, therefore, placed within brackets, the figure 2 being prefixed: had this been omitted, it would have been interpreted two equivalents of sesquioxide of iron, and three of sulphuric acid, and thus the equation would no longer be intelligible.

"Some chemists employ certain other abbreviations. Thus, in writing down the composition of certain minerals, instead of using the symbol for oxygen they express the number of equivalents of that element by dots or points placed over the symbol of the element with which it is associated; thus $\dot{F}e$ signifies protoxide of iron, and $2\,\dot{F}e$ or $\dot{F}e$ signifies two equivalents of the same oxide; $\dddot{S}$ expresses sulphuric acid, and $\dddot{S}^3$ or $3\,\dddot{S}$, three equivalents of that acid. When there are two equivalents of the electro-positive element, they are sometimes written by simply placing a dash underneath the symbol, thus $\ddot{\underline{Fe}}$ signifies sesquioxide of iron: $\ddot{\underline{Al}}$ means alumina; sometimes, however, the symbol itself is repeated instead thus, AlAl, FeFe. Compounds of sulphur are in like manner occasionally expressed by placing commas over the element with which the sulphur is associated; thus $A\overset{''}{s}$, $A\overset{'''}{s}$, $A\overset{''''}{s}$ are sometimes written for the three sulphurets of arsenic, and $\underline{S}n$, $\underline{\underline{S}}n$, and $\underline{\underline{\underline{S}}}n$, for the three sulphurets of tin. The formulæ of certain organic acids are, likewise, often abbreviated; thus $\underline{\underline{\underline{A}}}$, $\underline{\underline{\underline{T}}}$, $\underline{\underline{\underline{C}}}$, are written for acetic, tartaric, and citric acids, instead of the formulæ representing their composition as $C^4 H^3 O^3$; $C^3 H^4 O^{10}$; $C^{12} H^5 O^{11}$.

"The great advantages of this system of notation are particularly appreciated in the organic department of chemistry; besides the immense assistance it offers to the memory, it enables chemists to represent their theoretical views respecting the arrangement of the elements of certain compounds which would be wholly impossible from a mere statement of their per-centage composition as determined by analysis. We not unfrequently meet with two or more compounds which, though wholly unlike in their physical and chemical properties, yield nevertheless upon analysis the same elements in the same proportion; without the use of formulæ it would be quite impossible to give an intelligible representation of the constitution of such compounds, but with the aid of the symbolic language we can do so with the utmost perspicuity. The following may serve as an illustration.

"By distilling benzoic acid with sulphuric acid and pyroxylie spirit, an oily, fragrant liquid is obtained, which yields on analysis a per-centage composition answering to the formula $C^{16} H^8 O^4$. An oil of the same composition, but possessing totally different properties, is obtained by acting on oil of anise with dilute nitric acid. Lastly, by the action of dilute nitrie acid on cymol (a hydrocarbon obtained from oil of cummin) a crystalline substance having acid properties is obtained, the composition of which is likewise $C^{16} H^8 O^4$. In the language of chemistry these bodies are said to be isomeric; but it is evident that even the empirical formula, $C^{16} H^8 O^4$, does not point out the true constitution of each substance. The symbolic language, nevertheless,

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* Chemical Manipulation and Analysis, Qualitative and Quantitative. By Henry M. Noad, Lecturer on Chemistry at St. George's Hospital, author of "Lectures on Electricity," "Lectures on Chemistry," &c. Intended to form Part of a Series of Treatises on Chemistry in the Library of Useful Knowledge.

enables the chemist to exhibit, at a glance, his theoretical ideas respecting them. Thus the first of these oily compounds is considered to be a salt of the oxide of the hypothetical radical methyle ($C^4 H^3$), viz., the benzoate, and its composition is written thus :

$$(C^4 H^3)\ O + C^{14} H^5 O^3 = C^{16} H^8 O^4.$$

"The second is regarded as the hydride of another hypothetical radical, anisyle ($C^{16} H^7 O^4$), and is thus expresaed :—

$$(C^{16} H^7 O^4)\ H = C^{16} H^8 O^4.$$

The third, from the circumstances of its derivation, and from its great analogy to benzoic acid, may be considered as the hydrated oxide of another hypothetical radical ($C^{16} H^7 O^2$), corresponding to benzoyl, and be written thus :

$$(C^{16} H^7 O^2)\ O + HO = C^{16} H^8 O^4.$$

"NOMENCLATURE.

"We have already mentioned that the 59 elementary substances may be very conveniently arranged into two grand classes, viz., the metalloids and the metals. It has also been stated that, in giving names to these different bodies, no rule has, generally speaking, been observed, each particular discoverer following his own fancy in his selection. The names of compound bodies, however, are constructed in accordance with certain rules, and the system of nomenclature still followed is that of Lavoisier, which was constructed as far back as the year 1787, and which, though in some of its details it does not exactly accord with the views of the chemists of our day, is retained from the confusion and inconvenience which it has been felt would be introduced into the science by making any alterations which might not meet the absolute approval of the chemical philosophers of all countries.

"Of all the simple substances, the one which is the most plentifully diffused is oxygen; it is, moreover, the element the combinations of which are, on the whole, the most important. The founders of the chemical nomenclature naturally, therefore, directed their especial attention to the compounds of oxgen, and made them the basis of their system.

"Oxygen forms, with other simple bodies, three classes of compounds. I. Acids. II. Bases. III. Neutral or indifferent substances. The members of the two latter classes have received the name of oxides; oxide of potassium, oxide of iron, and oxide of lead furnish examples of basic oxides, and oxide of carbon may be quoted as an instance of an indifferent oxide. At the time the nomenclature was constructed, it was supposed that there could not exist more than two compounds of oxygen and the same body possessing *acid* characters; hence names were only provided for two acids with the same radical.

"To express the acid containing the smallest proportion of oxygen, the termination *ous* was given to the element forming the radical of the acid, and the termination *ic* was appended to signify the acid containing the largest proportion of oxygen. Thus two compounds of sulphur and oxygen were known: the first was called sulphurous and the latter sulphuric acid. But the progress of science has pointed out the existence of other acid compounds of sulphur and oxygen. One of these acids contains less oxygen than sulphurous acid; another contains more than sulphurous, but less than sulphuric, acid. To give names to these new substances, without disturbing the general principles of the nomenclature, the term *hypo* was introduced. Thus hyposulphurous acid expresses very conveniently the acid containing less oxygen than sulphurous acid, and hyposulphuric acid that containing less oxygen than sulphuric, but more than sulphurous, acid. In other cases acids were discovered containing more oxygen than the *ic* compound, and to meet such cases the term *hyper* was introduced: thus an acid compound of chlorine and oxygen is known which contains more oxygen than chloric acid; the name hyperchloric acid was given to this substance; it is now, however, more generally called perchloric acid.

"It frequently happens that the same body forms several compounds with oxygen which are either basic or indifferent. The Greek language is again resorted to for furnishing a means of distinguishing these different oxides. Thus there are three oxides of manganese and oxygen known: the first written symbolically is Mn O, and is called the protoxide; the second is written $Mn^2 O^3$,* and, as it contains once and a half as much oxygen as the protoxide, it is called the sesquioxide; these two oxides are bases, that is, they combine with oxygen acids forming definite salts; the formula of the third is Mn O^2, and, as it contains twice as much oxygen as the protoxide, it is called the deutoxide: this oxide is indifferent, that is, it does not form salts with oxygen acids, it is generally called peroxide of manganese, because it contains the largest proportion of oxygen with which the metal can combine to constitute an oxide; there are other compounds of manganese and oxygen, but these are distinct acids.

"Salts are named according to a very simple rule, the names of acid and base being so combined that the name of the acid shall determine the genus, that of the base the species. When the name of the acid terminates in *ic*, the generic name of the salt terminates in *ate*: thus salts of sulphuric acid are called sulphates: when the name of the acid terminates in *ous*, the generic name of the salt terminates in *ite*: thus salts of sulphurous acids are called sulphites: in the same manner we have hyposulphates and hyposulphites. The same acid sometimes combines with the same base in more than one proportion: thus we have two compounds of chromic acid and potassa, the symbols for which are KO, CrO^3 and KO, $2CrO^3$, and they are called respectively the chromate and the bichromate of potassa. Salts also exist in which the quantity of acid is less than that which exists in the neutral salt: these compounds are designated sub-salts; and, lastly, we are furnished in common alum with an instance of what is called a double salt, where a new and characteristic compound is formed by the union of two distinct salts. The formula for dry alum is KO, SO^3 + $Al^2 O^3$, $3SO^3$, which shows it to be composed of sulphate of potash and sulphate of alumina.

"The names given to the compounds formed by chlorine, iodine, and the other metalloids, either with the metals or with each other, are in strict accordance with the rules adopted for the oxygen compounds: thus we have chlorides, bichlorides, sesquichlorides, and perchlorides; iodides, bromides, fluorides, sulphides (sometimes called sulphurets), carbides (or carburets), phosphides (or phosphurets), hydrides (hydrurets), &c. Water is remarkable as acting sometimes the part of an acid and sometimes that of a base: when in the former capacity, the compound is called a hydrate, as the hydrate of potassa; when in the latter, the compound ought in strictness to be named by adding the word water to that of the acid, though this rule is often infringed; thus the strongest sulphuric acid of commerce is known to have the composition $SO^3 + HO$; it ought therefore to be called sulphate of water, though it is generally termed hydrated sulphuric acid, or hydrate of sulphuric acid.

"Certain of the metalloids form amongst each other energetic acids, as chlorine and hydrogen, iodine and hydrogen, fluorine and hydrogen, &c.; these are called hydrogen acids, and are named respectively hydrochloric, hydriodic, and hydrofluoric acids: it is here that the present nomenclature seems most defective, though it has not yet been thought advisable to make any important change, for the reasons already alluded to.

"We have lastly to remark that, from the great analogy subsisting between certain compounds of sulphur with the metalloids and metals, and the corresponding compounds with oxygen, the terms sulphur acids and sulphur bases have been introduced to designate two classes of compounds, which act towards each other precisely as oxygen acids and oxygen bases, giving rise to a series of true salts called sulphur salts. Sulphur and carbon, for example, combine together and form a compound which corresponds in its properties so completely with carbonic acid that it is called sulphocarbonic acid: it enters into combination with monosulphuret of potassium, forming a compound analogous to carbonate of potassa, and which has received the name of sulphocarbonate of monosulphuret of potassium."

[*To be continued.*]

* It is written $Mn^2 O^3$ instead of MnO $1\frac{1}{2}$, in order to avoid the inconvenience of introducing fractions, and to obviate the necessity of dividing the atom of oxygen, on the supposition that the equivalent numbers are actually expressive of the absolute weights of the individual atoms.

THE CHEMICAL TIMES.

SATURDAY, DECEMBER 2, 1848.

OUR OWN SERIES.

No. I.

ON CHEMICAL MANIPULATION.

A RECENT examination of our letter-file disclosed to our view several communications embodying advice so perfectly identical in tenor, that we are bound to consider it as a fair exponent of the wishes of such a considerable number of our correspondents, that we ought not in justice to ignore their request; the more particularly as the suggestion had more than once, before receiving the communications of our friends, crossed the threshold of our own brain. The suggestion relates to our furnishing a series of articles on the art of chemical manipulation, thus ministering to a want which all those who commence without a master's aid the study of chemistry have felt, and filling a recognised void in the English periodical literature of chemistry.

It would be totally useless to expatiate on the necessity for the acquirement of readiness of manipulation by all who desire to achieve any greater things in the science than the learning by rote of what other chemists have done. Without some considerable practice in manipulation, the most minute acquaintance with book knowledge would be ineffectual—the most profound suggestions of the mind would be worse than useless: they would tend to the building up of new theories to mislead and confuse.

If one and the same individual possessed a memory to grasp the whole circle of ascertained chemical truths, and an imagination to combine them in a host of probable relations,—still without the test of experiment the limits of chemistry would not be extended by the veriest line; and without the power of manipulation there can be no experiment.

We will suppose a novice in chemistry to be placed in a laboratory, to acquire the first principles of the manipulative art. What is first to be done?

Now, tremble all ye poetic dreamers who begin your philosophic career by fancying you are not born for detail—that you are the chosen ones of the genius of chemistry whom she will at once lead to her temples. Banish the idea from your minds! The first thing to be acquired in the way of manipulation is the method of cleaning,—thoroughly, accurately cleaning,—those glass instruments which chemists so largely employ in the course of their experiments.

If a reader smiles at the first lesson,—if he feels that we have touched his self-importance,—

if he he arrogant enough to imagine that he was born for better things, and to say or to feel that the cleaning of glass might better suit the genius of a waiter at an hotel, let us strongly advise such an one to walk out of the laboratory at once, and never think of becoming a chemist. He may rely upon it that his genius lies not in that direction.

Let him not think of compromising the matter by acknowledging the necessity for having perfectly clean glass, but finding a substitute to perform this most important operation. The compromise will not answer; the thing is not to be accomplished by a substitute; the learner must do it himself.

Instead of such an unwise aspirant after immediate chemical fame as he whom we have just announced to exist, we will suppose the learner to approach the most important operation of glass-cleaning with that kind of humility and consciousness of inadequacy which a sensible person in his position should feel; ready, in short, to listen patiently to any directions, and to act in accordance with them.

Let him ponder over the following remarks.

Glass vessels, as used by chemists, are of such various shapes and sizes that their accurate description would be impossible. As regards their facility of being cleaned, we may divide them into those of which the surface, internal or external, can be touched by the hand, and those which cannot. The chief amongst the former consist of test-glasses of various forms, glass jars used for the collection of gases, air-pump-receivers, and many other glass pieces quite unnecessary to mention. The complete purification of such glass apparatus is usually of no great difficulty. Should any of the glass pieces be soiled by oil or grease, as will be generally the case, provided they belong to the air-pump, or if they have been devoted to the purposes of gasholders, such oil, or grease, should be first wiped away as far as possible by a little rag or cotton waste, and then the glass well washed with a solution of pearlash in water, after which they are to be rinsed with pure water, and the greater portion of the moisture removed by means of a cloth. This being done, the glass pieces are now to be placed in a warm place to dry, and finally rubbed lustrously clear by means of a piece of chamois leather. The warming of the glass pieces previous to their polishing with chamois leather is important; indeed the young chemist will soon convince himself, by a few trials, that it is very difficult to wipe dry a cold and wet glass.

Test-glasses are of continual use in the laboratory, and in all cases they should be used accurately clean. And here we must remark that some general acquaintance with chemical principles are necessary in order to afford certain aids, equivalent to the use of pearlash in the case of glasses soiled by grease or oil. Thus, whilst test-glasses that have been used for containing clear liquids, which yield no precipitates on the contact of water, may be perfectly cleaned by careful rinsing, and subsequently drying and rubbing with chamois skin; other glasses, which have been used to contain liquids wherein the conditions just mentioned have been departed from, will require a peculiar treatment. For example, solutions of silver will, after a time, deposit on the sides of test-glasses used to contain them a shining metallic crust, which can only be imperfectly removed by means of pure water and friction; they may, however, be readily removed by a solution of iodide of potassium, and in some cases by ammonia. Again, lead salts deposit on glass such a white crust of the carbonate of lead as to render the glasses totally incapable of being cleaned without the aid of a chemical solvent. The question what solvent is to be employed must be determined by the general consideration of the chemical proportions of the carbonate of lead. Hydrochloric acid dissolves this body but imperfectly, and sulphuric acid not at all. Nitric acid, however, is a perfect solvent for it; and hence a weak solution of nitric acid is the best liquid to be employed for the purpose.

Thus it will be seen that the cleaning of a test-tube actually requires a certain amount of chemical science. Although some general idea of the nature of any chemical stain on glass is necessary in order to indicate the kind of agent most proper for its removal, yet it is but seldom that the operator need descend to particulars. Thus he may first try acids; if they are unsuccessful he may try alkaline bodies—one or the other will generally succeed. Whatever substance, however, may have been employed should be accurately rinsed away.

Test-glasses are of various shapes and sizes, according to the purposes for which they are destined to be used. In choosing them, other considerations being fulfilled, regard should always be had to the ease with which their interior may be reached with the finger. For ordinary purposes of testing, cylindrical glasses on feet, and capable of holding a fluidounce, are, perhaps, the most generally useful. They should be of such a depth that the forefinger may be capable of reaching to their deepest part; and care should be taken to select those which in that part are free from any protuberance, or any depression, either of which might seriously interfere with the cleaning operation.

[*To be continued.*]

THE VEGETABLE PHYSIC QUACKERY.

Will any individual learned in the philosophy of quack nostrums inform us wherefore it is that certain professors of that highly lucrative and profound branch of the medical art are so prone to associate the idea of some mystic innocence with preparations of vegetable origin? It is not in the spirit of aggravation we ask this, but with the pure desire of exploring a mystery which we have hitherto been totally unable to approach with the slightest hope of success.

Purifying vegetable pills—vegetable ointment—vegetable powders—those are expressions that meet our eye at every glance. We turn away from the paper-decorated hoards and thickly beplastered walls to give our eyes a little respite from the glaring exponents of the transcendant vegetable purifying theory. It is in vain Professor Morison, that bold and energetic man, ever anxious to propagate the salutary vegetable doctrine, obliges us again to contemplate the new hygeian philosophy in spite of ourselves. Some dozen peripatetic literati, each with board and placard, pass before our eyes, blazoning forth the peculiar virtues of the patent hygeian purifying vegetable pills.

Will anybody kindly inform us, we demand again, wherefore it is that a large section of the empiric tribe associate all that is innocent in physic with the vegetable world? It so happens that all the most virulent poisons are of vegetable origin. There is the deadly aconite, which kills in small fractions of a grain; and strychnia, a fourth part of a grain of which has killed a wild boar in a few seconds; and prussic acid, so prevalent in many botanical tribes. Then there are the deadly alkalis of hemlock and tobacco, and oxalic acid of treacherous fame; all derived from the vegetable kingdom! And yet the empiric physicmonger, forsooth, imposes on the credulity of an ignorant community by vaunting the innocence of vegetable medicines! Why, before the rapidly mortal action of some of the vegetable educts we have mentioned, arsenic, that terror of the mineral kingdom, is innocence itself; and sublimate is impotent. So much for the vegetable quackery!

STAITE'S ELECTRIC LIGHT.

Amongst the earlier experiments performed with the galvanic or voltaic battery was that of developing a brilliant light by transmitting the stream of electric fluid through the interval between two charcoal points.

Whilst the ancient batteries of Cruickshank and of Wollaston were generally in use, the full brilliancy of the voltaic light could only be brought out by the employment of enormous acting surfaces of copper and zinc. Hence the experiment could be only well performed by those favoured few who were in possession of unusually large batteries. Since, however, that the newer and more powerful galvanic batteries of Groves and Smee and Daniell have been brought commonly into vogue, there is scarcely a mechanics' institution in the three kingdoms, scarcely a school, the audience or inmates of which have not witnessed one or another of the various modifications of which the voltaic or galvanic light is susceptible.

The experiment, however, required care in its performance. The charcoal it was imperative to make specially for the purpose. That produced from certain woods alone would succeed. Of these boxwood or lignum vitæ was the best. Great care was necessary, too, in the burning of this wood, to make it into charcoal, a violent and long-continued heat being so necessary that many early writers on the subject recommended a glass-furnace as the best source of heat.

Even where the charcoal points were prepared with the greatest care scarcely any two of them were similar in the amount or regularity of light for equal amounts of voltaic electricity. In short, no dependence could be placed on any one piece of charcoal until tried. The light, too, although remarkably vivid, was devoid of that steadiness so necessary to adapt it to the purposes of illumination. Until the present time, then, despite many and oft-reiterated attempts by numerous experimentalists, the electric light continued to be a mere lecture-room plaything, totally unfitted for any practical application.

If, however, the chemical mechanician asked himself wherefore the light had not succeeded in practice, and what indications were necessary to be fulfilled in order that it should, the reply was simple. Two desiderata must be accomplished, and they were these:—1. To procure a

carbonaceous matter of definite aggregation. 2. To regulate the flow of the voltaic current in such a manner that a steady light should result.

Both these desiderata Mr. Staite has achieved, and applied a well known phenomenon of electricity to a practical purpose. The principle of Mr. Staite's invention is protected by letters patent: his last specification is not yet due, but from his first we gather a knowledge of the means he employs to prepare his carbonaceous sticks or points. Not relying on wood charcoal, as the greater number of Mr. Staite's predecessors had done, he prepares an artificial carbonaceous mass of known and unvarying physical condition; his process being as follows :—He reduces coke to impalpable powder, makes it into a paste with water, forms it into sticks, and exposes it to a violent heat. He then dips the sticks into melted sugar, so that every minute interstice may be filled up, and exposes to heat again. The result of this treatmeut is a carbonaceous mass of density superior to any that can be obtained from wood, and which moreover can easily be obtained in the form of straight sticks, an impossibility with charcoal made from wood, for, if prepared from the straightest pieces, the resulting charcoal will be almost invariably crooked. The first great desideratum is thus accomplished. The other desideratum, viz., a steady light, dependent on a regular flow of electricity and the maintenance of certain given relations of position between the two carbonaceous points, required certain mechanical appliances of a self-acting kind. Thus, in order to the development of the light, it was necessary that the two charcoal points should be first brought into contact; then separated and maintained (notwithstanding the shortening of the charcoal points as the result of combustion) at a given and unvarying distance from each other. These objects have been accomplished by the electric current itself on its passage towards the charcoal points, whence it is presently to emanate as light.

The instrument subservient to this end is somewhat on the principle of the galvanometer, consisting of a coil of copper wire surrounding a bar of soft iron. On passing the electric current through this coil the bar becomes magnetized, and is adapted to rise or fall as the current is strong or weak. These motions of rising and falling are caused to actuate an escapement by means of which an equable current of electricity is always maintained, and the charcoal points are held at a distance from each other proportionate to the passing amount of electric current.

Thus, in point of fact, the electro-magnetic regulator discharges the corresponding functions to the governor of the steam-engine.

During the recent exhibition of this light at the Hanover-square Rooms the familiar experiment was performed of causing the points to approximate under water, under which circumstances the light, as was well known, did not cease.

It is extraordinary that the electric light developed from charcoal points is not owing to combustion, in the ordinary sense of that term; nevertheless, for all practical purposes, combustion may be said to occur, the carbonaceous sticks losing about half an inch per hour of their length. When in action in a room the electric light neither takes from nor adds to the surrounding air any property whatever, a very important fact in large and crowded assemblies.

The inventor is preparing modifications of his lamps, with a view to shew the applicability of the discovery to every purpose of illumination. The cost of the light is about one twelfth that of gas; perfectly safe and harmless and easily managed; and no accidents can occur from explosion or from fire.

Subsequent to the writing of the preceding account of Staite's electric light there has been a public exhibition of it in Trafalgar-square. The result was satisfactory on the whole, but at times there were slight inequalities of the illuminating power, which proved that the inventor had not entirely overcome the great difficulties which beset the application of the electric light to general purposes of illumination.

THE USE OF THE BLOWPIPE.

This operation belongs exclusively to the province of analytical chemistry, and is of paramount importance in many analytical processes. We have to examine here, 1, the apparatus; 2, the mode of its application; and 3, the results of the operation.

The blowpipe is a small instrument, usually made of brass. It was originally used by metallurgists for the purpose of soldering, whence it derived the name of "soldering-pipe"—Löthrohr—by which the Germans designate it. It consists of three distinct parts; viz., 1st, a tube through which air is blown from the mouth; 2d, a small vessel into which this tube is ground air-tight—(this vessel serves to collect and retain the moisture of the air blown into the tube); —and 3d, a smaller tube, which is likewise closely fitted into this vessel, and forms a right angle with the large tube; this small tube has a very fine aperture at its anterior extremity. The blowpipe serves to conduct a fine and continuous stream of air into the flame of a candle or lamp. Such a flame presents, under ordinary circumstances, three distinct parts to the eye; viz., 1st, a dark nucleus in the centre; 2d, a luminous part surrounding this nucleus; and 3d, a kind of mantle encircling the whole flame, and but feebly luminous. The dark nucleus is formed by the gases which the heat evolves from the fuel; these gases cannot burn here, owing to want of oxygen. In the luminous sphere they come into contact with a certain amount of oxygen, although insufficient for their complete combustion. The hydrogen of the carburetted hydrogen gases evolved burns, therefore, principally here, whilst the carbon separates in a state of intense white heat, causing thus the luminousness of this part. In the outer coat the access of air is no longer limited, and all the gases not yet consumed are consumed. This part of the flame is the hottest. Oxidizable bodies oxidize, therefore, with the greatest possible rapidity, when placed in it, since all the conditions of oxidation are here united, viz., high temperature, and an unlimited supply of oxygen. This part of the flame is accordingly called the oxidizing flame.

On the other hand, oxides having a tendency to yield up their oxygen suffer reduction, when placed within the luminous part of the flame, the oxygen being withdrawn from them by the carbon and the still unconsumed carburetted hydrogen present in this sphere. The luminous part of the flame is, therefore, called the reducing flame.

Now, if we conduct a fine stream of air into a flame, we have oxygen, not merely around the outer, but also in the inner, part. Combustion takes place, therefore, in both parts. But this stream of air, rushing with a certain force into the flame, carries forward the gases evolved, mixes intimately with them, and effects their combustion at a certain distance from the aperture of the blowpipe. This point, which is marked by a bluish light, is the hottest part of the whole flame, since the intimate intermixture of the air with the gases favours here the most complete combustion. The luminous part of the flame, being thus surrounded on both sides by very hot flames, acquires likewise an extraordinary increase of heat; this elevation of temperature forms the principal object which we intend to attain by the application of the blowpipe. The hottest part of the flame lies now, of course, somewhat beyond the apex of the inner nucleus. In a reducing flame of this description many bodies will fuse readily, which a common flame would fail to effect. The heat of the oxidizing flame also is considerably increased by the blowpipe being more strongly concentrated upon one point.

For fuel we use either an oil-lamp, a wax candle, or a lamp fed with a solution of oil of turpentine in spirits of wine. A common spirit-lamp does not always produce the necessary degree of heat.

The current is to be produced with the cheek-muscles alone, and not with the lungs. The way of effecting this may be readily acquired by practising for some time to breathe calmly, with puffed-up cheeks, and whilst holding the blowpipe between the lips; a little practice and patience will soon enable the student to produce a continuous, even, and steady current.

The supports on which the substances to be examined are exposed to the blowpipe flame are generally either wood, charcoal, or platinum wire or plate. In the choice of charcoal intended for blowpipe experiments, we have to look more particularly to the coal being thoroughly charred, because, if not so, it will split and throw off the substances placed on it. The substances to be examined are put into small conical cavities scooped with a penknife, or with a little tin tube. We generally employ charcoal as a support when we want to reduce a metallic oxide, or to ascertain the degree of fusibility of a substance.

Metals which are volatile at the heat of the ordinary flame evaporate wholly, or in part, upon the reduction of their oxides. But these metallic vapours are reoxidized in passing through the outer flame, and the oxide thus produced forms a slight incrustation around the substance upon the charcoal. Many of these incrustations exhibit characteristic colours which serve to assist in the detection of the metals.

The platinum wire, as well as the platinum plate, should be selected rather thin. We make use of platinum wire generally when fusing bodies in conjunction with fluxes, for the purpose of inferring their nature from the colour and other properties of the button produced.

What renders the application of the blowpipe particularly useful in chemical experiments is the great facility with which the intended results are attained. The results are of a twofold kind, viz., either they afford us simply an insight into the general properties of the examined body, and enable us accordingly only to determine the class to which it belongs, *i.e.*, whether it is fixed, volatile, fusible, &c. &c.; or the phenomena which we observe enable us at once to recognise the particular body which we have before us.—*Chemical Analysis by Fresenius.*

THE CHOLERA.

The Registrar-General's return of the births and deaths registered in London during the week ending on Saturday last gives the number of deaths as 1,207, being 53 above the weekly average of the five autumns ending in 1847. Of these 34 are from cholera, being 33 above the average.

The deaths from cholera since September 23, up to November 25, have been:—In the west districts, 21; north, 14; central, 13; east, 59; south, 241; total, 348. It is observed that, of the 348 deaths from cholera, not less than 241 have occurred on the south side of the Thames. In the last week, however, there were 17 deaths in the east districts.

Subjoined is a detailed statement of the fatal cases of cholera registered in the week ending Saturday, the 25th ultimo. Five are cases in which inquests were held; the remainder are all certified by medical attendants:—

Kensington; town.—At Jenning's-buildings, hawker, 45, "cholera."

Hackney; sub district Hackney.—F. 37, "Asiatic cholera" (60 hours).

St. Giles; South.—F. 4, "natural, sudden; believed by the surgeon to be cholera" (p.m.); inquest.

Shoreditch; St. Leonard.—At 6, Burnall's-buildings, Kingsland-road, F. unmarried, a willow-weaver, 29, "Asiatic cholera (11 hours)." [Mr. Burchell, the medical attendant, states that "the deceased was taken ill with premonitory symptoms whilst at work at her mother's, in Fountain-alley, Virginia-row, Bethnal-green

(said to be a very filthy, unwholesome place), at 6h. p.m., November 22. At half-past 7, when I was called to her, she laboured under every symptom of Asiatic cholera, the prostration being extreme. This continued till 5h. a m. of the 23d, when she expired, 11 hours from the first attack. Her living has been very scanty for some considerable period, and she never had animal food more than once a week. Burnall's-buildings are comparatively clean and healthy; much more so than the confined courts around this locality generally are." Mr. Yarrow, the registrar, adds, that he "had carefully examined all the tenements in the place, and could find no ground of complaint with regard to water and cleanliness, or any circumstance except want of food from extreme poverty. She had two children, the second only a few weeks old. Her earnings averaged 3s. 6d. per week, 1s. of which she paid for supporting the infant. Before the attack she had partaken plentifully for dinner of fried turnips and carrots, which had been boiled three days previously, and at the same time of tea. All the inhabitants of the court are of the lowest class, and in circumstances of equal distress with those of the deceased."]

Shoreditch; Haggerstone, East. — F. 65, "cholera (24 hours); constitution much enfeebled previously to the attack."

Bethnal-green; the Green.—F. 45, "natural death—sudden, from cholera," inquest; F. 5, "typhus (9 days), Asiatic cholera (2 days)."

Whitechapel; Spitalfields.—F. 23, "Asiatic cholera (6 days); premature labour (13 hours). She was recovered from cholera when labour came on." Mile-end New-town.—At 21, Booth-street, wife of a carman, 34, "cholera (6 days)." Goodman's-fields.—At 17, White-bear-court, Lambeth-street, F. 45, "cholera (18 hours);" at the same house, F. 2, "natural death, sudden, from Asiatic cholera," inquest; at 10, opposite, F. 5, "Asiatic cholera (4 days)." [This court has 21 houses, which have two rooms in each. Most of these houses contain two families. The width of the court is only 5 feet, with very bad drainage. There is one water-tank for the supply of the inhabitants. The inhabitants are very poor, and several persons have been taken ill.—Note by Mr. Taylor, the registrar.]

Stepney; Wapping.—At 7, Chancery-place, Shadwell, labourer, 40, "natural death; sudden from Asiatic cholera; diarrhœa (3 days), cholera (18 hours);" inquest. At the same house, F., servant, 20, "sudden from Asiatic cholera; diarrhœa (2 days), cholera (12 hours);" inquest. [Mr. Ross, the registrar, states that "this is a close confined court, consisting of 11 houses, each house having two rooms with no back yard. The rooms are about 12 feet square. Nearly opposite No. 7 are three open privies, and facing the court a foul and offensive drain emitting the most disgusting effluvia. Fifteen persons lived in No. 7, nine in the upper room, and six in the lower. The 11 houses are inhabited by 71 persons. The above cases of cholera, when first seen by me, exhibited a perfect state of collapse, and terminated fatally a few hours after.]

Poplar; sub-district Poplar.—M. 48, "spasmodic cholera (30 hours), collapse (4 hours)." Bow and Bromley.—At Grove-hall Lunatic Asylum, F. 49, "cholera (21 hours)." In the same institution, F. 50, "cholera (3 days)." In the same institution, F. 28, "cholera (5 days)." In the same institution, F. 61, "cholera (4 hours)." In Old Ford, Bow, by the side of the Lea, F. 68, "cholera (1 day)."

Bermondsey; St. James's.—M. 9 months, "Asiatic cholera (10 hours)."

St. George's, Southwark; Kent-road.—At 58, Henry-street, hawker, 32, "spasmodic cholera." London-road.—M. 36, "English cholera (15 days); affection of the heart of long standing."

Lambeth; Church, Second Part.—At 30, Devonshire-street, carman, 52, "cholera (5 days)." [He was a robust person. Shortly before the attack he ate a hearty dinner. His occupation consisted chiefly in the removal of nightsoil, emptying cesspools and drains. Another man who worked with him was seized during his illness, and died in a few hours.]

St. Giles's; Camberwell.—At 9, Picton-street, spinster, bookfolder, 40, "Asiatic cholera (14 hours)."

Rotherhithe; sub-district Rotherhithe.—F. 51, "cholera and fever (3 days)." F. 11, "Asiatic cholera (55 hours)."

Greenwich; Greenwich, West.—In the *Dreadnought* Hospital, M. 22, "cholera" (*post mort.*). In the same ship, M. 53, "cholera" (*post mort.*). In the same ship, M. 43, "cholera" (*post. mort*). In the same ship, M. 39, "cholera" (*post mort.*).

Wandsworth, &c.; Clapham.—F. 66, "diarrhœa (4 days), cholera (2 days)." M. 3, "diarrhœa (12 hours); cholera (2 hours)." Battersea.—At Sleaford-street, son of a labourer, 8, "malignant cholera (14 hours)."

On Tuesday Mr. Simon, the medical officer of health, reported to the court of sewers that no case of cholera had occurred since he had made his last report. He, however, repeated that he considered it necessary that he should be supplied with the particular returns from the medical officers of the city unions for which he had in the first instance applied, as an indispensable means of enabling him to adapt the sanitary regulations to the various contingencies which might arise.

Asiatic Cholera at Wapping.—On Tuesday afternoon Mr. W. Baker, coroner for this district of the metropolis, held two inquests at the Old George Tavern, Anchor and Hope-alley, Wapping, on the bodies of Grace Moore, aged fifty, and Jane Brown, aged twenty-nine, the wives of seafaring men, who were attacked with this malignant disease within two hours of each other, and who died shortly after the disease made its appearance. From the evidence adduced, which was of a voluminous character, it was elicited that the deceased persons resided in adjoining rooms in the same house, No. 7, Anchor and Hope-alley. The neighbourhood is densely populated and closely contiguous to the Thames, and, though it was stated that the drainage was perfect, it appeared that the ventilation was extremely bad, the ingress of fresh air being almost wholly excluded by the London-dock wall, which rears its gigantic proportions some sixty feet high immediately against the rear of the houses in question. Moore was attacked with the usual symptoms at ten o'clock on Saturday night. Mr. Lammerman, surgeon, was called at two o'clock the following morning, when he found her labouring under all the symptoms of virulent Asiatic cholera. She died at two o'clock in the afternoon. Brown was seized at twelve o'clock on Saturday night. At three in the morning she was seen by Mr. Godfrey, the parish surgeon, and at eight o'clock in the evening she expired. Mr. Godfrey in his evidence alluded to the crowded state of the neighbourhood, and stated that in the house in question four or five persons slept in one room. He also attributed a very evil influence to the dock wall alluded to. The coroner in summing up observed that though only four hours had elapsed in these cases between the period of the attack and the attendance of medical men, and though that might appear to be very speedy relief, yet he did not doubt, if medical assistance had been procured upon the instant of the premonitory symptoms appearing, their lives might have been spared. He should write to the board of guardians upon the subject, recommending them to issue placards to that effect. Verdict—"Natural death from Asiatic cholera."—*Times.*

CURLING ON CHLOROFORM AND ETHER AS ANÆSTHETICS.

It is well known that the vapour of ether was first exhibited for the prevention of pain in operations in the United States of America. There are several claimants for the honour of this discovery; but the chief merit appears to be due to Dr. Morton, a dentist practising in Boston. This gentleman, whilst engaged in experiments made for the purpose of obviating pain in surgical operations, communicated the object of his inquiries to Dr. Jackson, a lecturer on chemistry, who suggested a trial of sulphuric ether. Dr. Morton, availing himself of this hint, experimented with ether first upon himself, and then upon others, with perfect success in regard to the object he had so long had in view; and, having constructed a suitable apparatus for administering the vapour, he communicated the results of his inquiries to Dr. Warren, surgeon of the Massachusetts General Hospital, who, after satisfying himself of its efficacy, introduced the practice into the hospital, and performed the first important operation under its influence.

Etherization was resorted to for the first time in this country by the late Mr. Liston, in December, 1846, in the amputation of a thigh at the University College Hospital. During the past year ether has been employed at all our large hospitals, and I may say by every operating surgeon in Great Britain, and likewise very generally by the surgeons of France, Germany, and Italy. In the month of November last Professor Simpson, of Edinburgh, announced to the profession a new anæsthetic agent, called chloroform, as a substitute for ether, over which it was represented to possess some important advantages. It appears that some months previously this compound had been experimented upon and tried by others, but Dr. Simpson is undoubtedly entitled to the credit of having established its claims as a valuable remedy for pain.

Ether and chloroform are undoubtedly agents of vast power, and, as experiments on animals plainly show, if taken in a sufficient quantity they produce death. The effects of their inhalation when carried, as I have sometimes witnessed without any inconvenient result, to such an extent that all consciousness and sensibility are destroyed, the pulse scarcely to be felt, the pupils dilated, the muscles relaxed, the limbs motionless, the breathing laboured, and almost stertorous, with puffing of the flaccid cheeks, and the countenance having the appearance of a person struck with apoplexy, would excite alarm in any one who witnessed them for the first time. Yet it is an astonishing fact that, although these powerful agents have been given during the past twelvemonth to an immense number of people, even for curiosity and pleasurable excitement, as well as for the most trifling and most important operations; often by persons totally inexperienced in their administration, and with defective and objectionable inhalers, the preparations themselves, too, being frequently impure; we can say of them, what cannot be asserted of any agent of equal power, that there is no authentic account of more than a single instance in this country in which death has been caused simply by their poisonous operation. The fatal case alluded to is one of recent occurrence, near Newcastle-upon-Tyne, which has naturally produced a strong impression on the public mind, adverse for the moment to the reception of these remedies; but which, I have no hesitation in saying, has not shaken my confidence in them in the slightest degree. It appears that a girl, about fifteen years of age, inhaled chloroform previously to undergoing a painful but otherwise unimportant operation, and expired from its effects in about three minutes. Sir John Fife, a surgeon of eminence, who has acquired considerable experience in the use of chloroform in operations, and who examined the body, in his evidence at the inquest expressed the opinion that the unfortunate result was owing to some peculiarity in the girl's constitution.* There are accounts

* Dr. Simpson attributes the death in this case to asphyxia, from the means used to restore the girl from the state of anæsthesia.—(*Lancet*, Feb. 12, 1848.) He very properly cautions the profession against giving strong drinks to persons profoundly affected by chloroform, recommending the sprinkling of cold water to the face, and the excitement of respiratory acts, as the means best calculated to revive the patient. Both in man and animals I have

of some two or three other cases in which so deep a collapse has been produced by these agents, more especially by chloroform, that life has apparently been endangered, and restoratives have been resorted to in order to revive the sinking powers. That alarming effects of this kind should occasionally arise, or that a death should occur on the introduction of these remedies, from an over-dose, or in persons peculiarly susceptible to their influence, is no more than might reasonably be expected, considering their great power. But no further importance can be attached to these accidents than as inculcating greater care and caution in the use of these agents, and as discouraging their indiscriminate employment in trifling cases, and in operations attended with only slight and momentary pain. Powerful, therefore, as are these remedies, all who are experienced in their use agree that they are, on the whole, safe and manageable; and their safety peculiarly depends on the transitory and evanescent nature of their influence; for, from the moment they cease to be inhaled, they begin to pass off rapidly from the system in expiration, and their influence declines; so that, whatever risk may be incurred by their rash, careless, and unnecessary use, scarcely any apprehension need be entertained from their skilful and cautious administration. As in using other active remedies, no one should give ether or chloroform vapour without having carefully studied their effects on the human body. In operations, especially the more important, the surgeon should be relieved from all care and responsibility connected with the inhalation, and his mind left free to be directed solely to the steps of the operation. In these cases the administration of anæsthetic agents should, if possible, be entrusted to a person who, by practice, has acquired a nice perception of their action, and a full knowledge of their powers and varying effects, so as to be able to produce and maintain their influence in a proper degree, until the operator has ceased to use the knife, or to subject his patient to pain.

There are certain states in which the full effects of anæsthetic agents cannot be produced without danger; as in organic diseases of the heart, especially a dilated or weak heart; and in tendencies to congestion of the brain in plethoric individuals. We are not often called upon to operate under such circumstances, and it will be the duty of the surgeon to discriminate accordingly. But these cases constitute no objection to their being given to the majority of persons about to undergo operations. We might as reasonably exclude some of our most valuable remedies, such as morphia, digitalis, and prussic acid, from the Materia Medica, as object to the use of anæsthetic agents, because there are particular conditions of disease and of the system in which they operate injuriously; or because an excessive dose is calculated to cause death.

There is another point which it is important for the surgeon to bear in mind when operating on patients powerfully affected by chloroform; and this is, the liability to secondary hemorrhage, if particular care be not taken to secure the principal vessels divided. The action of the heart is sometimes rendered so feeble by this agent, that it often happens that vessels of considerable size, when cut, pour out scarcely any blood, and consequently easily escape observation; but after the patient has been sent to bed, and the influence of the chloroform has passed off, free bleeding is liable to ensue. By attention to the sources of bleeding during the operation, and taking care to have the patient properly watched for a short time afterwards, in cases where any risk of hemorrhage appears to exist, all danger from this cause may be readily avoided.

The chief inconveniences arising from the use of anæsthetic agents are vomiting and excitement, attended with more or less violent action of the muscles. The former may be avoided by directing that no meat be given for a few hours before the operation. The excitement prevents the operator from proceeding, but it is only occasionally manifested as the agent first begins to act on the system, and it may generally be subdued by persisting in the inhalation. I have repeatedly witnessed powerful muscular action stilled in a few seconds by gently restraining the patient and persevering in the use of the remedy.—*Curling's Hunterian Address.*

been struck with the rapidity of recovery from blowing on the face and the application of cold.

WHITE LEAD.

Mr. Thomas Richardson, of Newcastle, one of the most distinguished chemists of Liebig's school, obtained a patent in December, 1839, for a preparation of sulphate of lead, applicable to some of the purposes to which the carbonate is applied. His plan is to put 56 pounds of flake litharge into a tub, to mix it with one pound of acetic acid (and water) of specific gravity 1.046, and to agitate the mixture till the oxide of lead becomes an acetate. But, whenever this change is partially effected, he pours into the tub, through a pipe, sulphuric acid of specific gravity 1.5975, at the rate of about 1 pound per minute, until a sufficient quantity of sulphuric acid has been added to convert all the lead into a sulphate; being about 20 parts of acid to 112 of the litharge. The sulphate is afterwards washed and dried in stoves for the market. I have examined the particles of this white lead with a good achromatic microscope, and found them to be semi-crystalline, and semi-transparent, like all the varieties of carbonate precipitated from the saline solutions of the metal. Mr. Leigh, surgeon, in Manchester, prepares his patent white lead by precipitating a carbonate from a solution of the chloride of the metal by means of carbonate of ammonia. On this process, in a commercial point of view, no remarks need be made. In Liebig and Woehler's "Annalen" for May, 1843, Chr. Link has communicated his investigation of two sorts of lead, prepared in the Dutch way, by the slow action of vinegar and carbonic acid upon metallic lead, under the heat of fermenting horse-dung. The one sort was manufactured by Sprenger, the other by Klagenfurth of Krems. He also examined three specimens of the Offenbach white lead. They all agreed in composition; affording 11.29 per cent. of carbonic acid, and 2.23 of water; corresponding to the formula, $2\,(PbO, CO^2) + PbO, H^2O$; that is, in words, 2 atoms of carbonate of lead with 1 atom of oxide and 1 atom of water—in round numbers, thus, $2 \times 134 + 112 + 9$. Mulder observed specimens of white lead, of different atomic proportions of carbonate, oxide, and water from the above, and discovered that the quality improved as the carbonate increased. The white lead by the Dutch process, as made by Messrs. Blackett, of Newcastle, is certainly superior as a covering oil pigment to all others. Its particles are amorphous and opaque. A patent was granted to Mr. Hugh Lee Pattinson in September, 1841, for improvements in the manufacture of white lead, &c. This invention consists in dissolving carbonate of magnesia in water impregnated with carbonic acid gas, by acting upon magnesian limestone, or other earthy substances containing magnesia in a soluble form, or upon rough hydrate of magnesia in the mode hereafter described, and in applying this solution to the manufacture of magnesia and its salts, and to the precipitation of carbonate of lead from any of the soluble salts of lead, but particularly the chloride of lead; in which latter case the carbonate of lead, so precipitated, is triturated with a solution of caustic potash or soda, by which a small quantity of chloride of lead contained in it is converted into hydrated oxide of lead, and the whole rendered similar in composition to the best white lead of commerce. The manner in which these improvements are carried into effect is thus described by the patentee:—"I take magnesian limestone, which is well known to be a mixture of carbonate of lime and carbonate of magnesia, in proportions varying at different localities; and, on this account, I am careful to procure it from places where the stone is rich in magnesia. This I reduce to powder, and sift it through a sieve of forty or fifty apertures to the linear inch. I then heat it red hot in an iron retort or reverberatory furnace, for two or three hours, when, the carbonic acid being expelled from the carbonate of magnesia, but not from the carbonate of lime, I withdraw the whole from the retort or furnace, and suffer it to cool. The magnesia contained in the limestone is now soluble in water impregnated with carbonic acid gas, and to dissolve it I proceed as follows:—I am provided with an iron cylinder, lined with lead, which may be of any convenient size, say 4 ft. long by 2½ ft. in diameter; it is furnished with a safety-valve and an agitator, which latter may be an axis in the centre of the cylinder, with arms reaching nearly to the circumference, all made of iron and covered with lead. The cylinder is placed horizontally, and one extremity of this axis is supported within it by a proper carriage, the other extremity being prolonged, and passing through a stuffing-box at the other end of the cylinder, so that the agitator may be turned round by applying manual or other power to its projecting end. A pipe, leading from a force-pump, is connected with the under side of the cylinder, through which carbonic acid gas may be forced from a gasometer in communication with the pump, and a mercurial gauge is attached, to show at all times the amount of pressure within the cylinder, independently of the safety-valve. Into a cylinder of the size given I introduce from 100 to 120 lbs. of the calcined limestone with a quantity of pure water, nearly filling the cylinder; I then pump in carbonic acid gas, constantly turning the agitator, and forcing in more and more gas, till absorption ceases, under a pressure of five atmospheres. I suffer it to stand in this condition three or four hours, and then run off the contents of the cylinder into a cistern, and allow it to settle. The clear liquor is now a solution of carbonate of magnesia in water impregnated with carbonic acid gas, or, as I shall hereafter call it, a solution of bicarbonate of magnesia, having a specific gravity of about 1.028, and containing about 1,600 grains of carbonate of magnesia to the imperial gallon. I consider it the best mode of obtaining a solution of bicarbonate of magnesia from magnesian limestone, to operate upon the limestone after being calcined at a red heat in the way described; but the process may be varied by using in the cylinder the mixed hydrates of lime and magnesia, obtained by completely burning magnesian limestone in a kiln, as commonly practised, and slaking it with water in the usual manner; or, to lessen the expenditure of carbonic acid gas, the mixed hydrates may be exposed to the air a few weeks till the lime has become less caustic by the absorption of carbonic acid from the atmosphere. Or the mixed hydrates may be treated with water, as practised by some manufacturers of Epsom salts, till the lime is wholly or principally removed; after which the residual rough hydrate of magnesia may be acted upon in the cylinder, as described; or hydrate of magnesia may be prepared for solution in the cylinder, by dissolving magnesian limestone in hydrochloric acid, and treating the solution or a solution of chloride of magnesium, obtained from sea-water by salt-makers in the form of bittern, with its equivalent quantity of hydrate of lime, or of the mixed hydrates of lime and magnesia, obtained by completely burning magnesian limestone, and slaking it as above. When I use this solution of bicarbonate of magnesia for the purpose of preparing magnesia and its salts, I evaporate it to dryness, by which a pure carbonate of magnesia is at once obtained, without the necessity of using a carbonated alkali, as in the old process; and from this I prepare pure magnesia by calcination in the usual manner; or, instead of boiling to dryness, I merely heat the solution for some time to the boiling-point, by which the

excess of carbonic acid is partly driven off, and pure carbonate of magnesia is precipitated, which may then be collected, and dried in the same way as if precipitated by a carbonated alkali. If I require sulphate of magnesia, I neutralize the solution of bicarbonate of magnesia with sulphuric acid, boil down, and crystallize; or I mix the solution with its equivalent quantity of sulphate of iron, dissolved in water, heated to the boiling-point, and then suffer the precipitated carbonate of iron to subside; after which I decant the clear solution of sulphate of magnesia, boil down, and crystallize as before. When using this solution of bicarbonate of magnesia for the purpose of preparing carbonate of lead, I make a saturated solution of chloride of lead in water, which, at the temperature of 50° or 60° F., has a specific gravity of about 1.008, and consists of 1 part of chloride of lead dissolved in 126 parts of water. I then mix the two solutions together, when carbonate of lead is immediately precipitated; but in this operation I find it necessary to use certain precautions, otherwise a considerable quantity of chloride of lead is carried down along with the carbonate. These precautions are, first, to use an excess of the solution of magnesia, and, secondly, to mix the two solutions together as rapidly as possible. As to the first, when using a magnesian solution, containing 1,600 grs. of carbonate of magnesia per imperial gallon, with a solution of chloride of lead saturated at 55° or 60° F., 1 measure of the former to $8\frac{1}{2}$ of the latter is a proper proportion; in which case there is an excess of carbonate of magnesia employed, amounting to about an eighth of the total quantity contained in the solution. When either one or both the solutions vary in strength, the proportions in which they are to be mixed must be determined by preliminary trials. It is not, however, necessary to be very exact, provided there is always an excess of carbonate of magnesia amounting to from one eighth to one twelfth of the total quantity employed. If the excess is greater than one eighth no injury will result, except the unnecessary expenditure of the magnesian solution. As to the second precaution, of mixing the two solutions rapidly together, it may be accomplished variously; but I have found it a good method to run them in two streams, properly regulated in quantity, into a small cistern, in which they are to be rapidly blended together by brisk stirring, before passing out, through a hole in the bottom, to a large cistern or tank, where the precipitate finally settles. The precipitate thus obtained is to be collected, washed, and dried, in the usual manner. It is a carbonate of lead very nearly pure, and suitable for most purposes; but it always contains a small portion of chloride of lead, seldom less than from 1 to 2 per cent., the presence of which, even in so small a quantity, is somewhat injurious to the colour and body of the white lead. I decompose this chloride, and convert it into a hydrated oxide of lead by grinding the dry precipitate with a solution of caustic alkali, in a mill similar to the ordinary mill used in grinding white lead with oil, adding just so much of the ley as may be required to convert the precipitate into a soft paste. I allow this paste to lie a few days, after which, the chloride of lead being entirely, or almost entirely, decomposed, I wash out the alkaline chloride formed by the reaction, and obtain a white lead, similar in composition to the best white lead of commerce. I prepare the caustic alkaline ley by boiling together, in a leaden vessel, for an hour or two, 1 part, by weight, of dry and recently-slaked lime, 2 parts of crystallized carbonate of soda (which, being cheaper than carbonate of potash, I prefer), and 8 parts of water."—*Ure's Supplement to Arts, Manufactures, and Mines.*

RECENT CHEMICAL PATENTS.

Charles Fielding Palmer, of Birmingham, druggist, for a new and improved chalybeate water. Patent dated April 27, 1848. Enrolled October 27, 1848.—The object of this patent is the manufacture of an artificial chalybeate water, in which the protoxide of iron is held in solution in water impregnated with carbonic acid gas. The process is as follows:—Take four parts (by weight) of protosulphate of iron, one and a half parts of acetic acid, forty parts of water, and twenty parts of syrup. These are treated as follows:—The acetic acid is first dissolved in the water, the protosulphate of iron is then added, and afterwards the syrup; this combination is then put into several bottles. The patentee states, he generally makes it of two separate degrees of strength, the first having the proportion of two grains of the protosulphate in each bottle of four fluid ounces; the other has double that quantity of the protosulphate. The bottles are now filled up with a solution containing carbonate of soda, and carbonate of potash, impregnated with free carbonic acid gas. The bottles are now corked, under pressure, to retain the carbonic acid gas, in the usual manner. The patentee does not confine himself to the use of acetic acid in the manufacture, as tartaric acid may be used. The patentee claims the making a solution in which any neutral or basic protosalt of iron, in conjunction with any other salt, is held in solution in water, charged with carbonic acid gas, which solution shall yield a precipitate upon the application of heat. If this new chalybeate water be of any value, the patentee will find that his specification is not sufficiently definite to prevent its easy evasion.

PATENTS RECENTLY INITIATED.

ENGLISH PATENTS FOR THE WEEK ENDING NOVEMBER 23, 1848.

Alexander M'Dougal, of Longsight, Manchester, chemist, and Henry Rawson, of Manchester, agent, for improvements in the manufacture of sulphuric acid, nitric acid, oxalic acid, chlorine, and sulphur. Patent dated November 21, 1848; six months.

Thomas Cullen, of the city of London, gentleman, for improvements in apparatus for steering ships and other vessels. Patent dated November 18, 1848; six months.

John Oliver York, of 20, Rue de la Madeleine, Paris, engraver, for his invention of improvements in the manufacture of metallic tubes. Patent dated November 21, 1848; six months.

Thomas Masters, of Regent-street, for certain improvements in apparatus for making aërated waters, and in apparatus for charging bottles, and other vessels, with gaseous fluid; also improvements in bottles and other vessels, and in apparatus for drawing off liquids; in securing corks or stoppers in bottles or other vessels, and in taps and vent-pegs. Patent dated November 18, 1848; six months.

William Hood Clement, of the city of Philadelphia, for certain improvements in the manufacture of sugar, part of which improvements are applicable to evaporation generally; also improved apparatus for preparing the cane trash to be used as fuel. Patent dated November 21, 1848; six months.

Hugh Bell, of London, Esq., for certain improvements in aërial machines, and machinery in connection with the buoyant power produced by gaseous matter. Patent dated November 23, 1848; six months.

Henry Newson, of Smethwick, near Birmingham, for an improvement or improvements in trusses. Patent dated November 23, 1848; six months.

Christian Schiele, of Manchester, mechanician, for certain improvements in the construction of cocks or valves, which improvements are also applicable for reducing the friction of axles, journals bearings, or other rubbing surfaces in machinery in general. Patent dated November 23, 1848; six months.

Peter Llewellin, of Bristol, brass and copper manufacturer, and John Hammons, of the same place, brassfounder, for improvements in the manufacture of cocks or valves for drawing off liquids. Patent dated November 23, 1848; six months.

Frederick Bramwell, Mill-wall, Poplar, engineer, and Samuel Collet Homersham, of the Adelphi, gentleman, for improvements in feeding furnaces with fuel. Patent dated November 23, 1848; six months.

Henry Archer, of Great George-street, Westminster, gentleman, for improvements in facilitating the division of sheets or pieces of paper, parchment, or other simple substances. Patent dated November 23, 1848; six months.

LIST OF PATENTS INITIATED IN IRELAND FROM THE 20TH DAY OF OCTOBER TO THE 20TH DAY OF NOVEMBER, 1848, INCLUSIVE.

Henry Highton, of Rugby, in the county of Warwick, clerk, master of arts, and Edward Highton, of Regent's-park, in the county of Middlesex, civil engineer, for improvements in electric telegraphs. Sealed November 8, 1848.

John Miller, of Henrietta-street, Covent-garden, in the county of Middlesex, gentleman, for a new system of accelerating mcnattrite locomotion, even by animal impulsion, for every species of transport machines acting by means of wheels, whether on land or water. Sealed Oct. 28, 1848. (Communication.)

William Sager, of Rochdale, in the county of Lancaster, wool-dealer, for certain improved means and apparatus for effecting the transit or conveyance of goods, passengers, and correspondence, by land or water, and for other such purposes, part or parts of which means and apparatus constitute a new and improved method of generating steam, which improvement is applicable to other purposes to which steam is generally applied as a motive power. Sealed Oct. 28, 1848.

Peter Fairbairn, of Leeds, in the county of York, machine-maker, for improvements in machinery for heckling, carding, drawing, roving, and spinning flax, hemp, tow, silk, and other fibrous substances. Sealed Nov. 11, 1848.

PATENTS RECENTLY EXPIRED.

R. Whitesides, of Ayr, wine-merchant, for certain improvements in the wheels of steam-carriages, and in the machinery for propelling the same, also applicable to other purposes. Patent dated November 20, 1834; expired Nov. 20, 1848.

W. Wells, machine-maker, and G. Scholefield, of Salford, mechanical draftsman, for an improved apparatus or machine for cutting the pile or cords of fustians and other fabrics manufactured of cotton, wool, and other fibrous materials. Patent dated November 20, 1834; expired November 20, 1848.

J. Lutton, of Middlesex, chair-maker, for certain improvements in castors for furniture. Patent dated November 25, 1834; expired Nov. 25, 1848.

J. T. Slade, of Middlesex, gentleman, for an improved metallic sheathing for the bottoms of ships and vessels. Patent dated November 25, 1834; expired November 25, 1848.

J. Donkin, of Bermondsey, engineer, for certain improvements in machinery for making paper. Patent dated November 25, 1834; expired November 25, 1848. (Communication.)

R. J. Barlow, of Rudley, for certain improvements in springs, applicable to carriages and other purposes. Patent dated November 25, 1834; expired November 25, 1848.

J. Couch, of Stoke, Devonport, Capt. R.N., for certain improvements in ships' channels. Patent dated November 25, 1834; expired Nov. 25, 1848.

W. Crofts, of Nottingham, machine-maker, for certain improvements in certain machinery for making figured or ornamented bobbin-net, or what is commonly called ornamented bobbin-net lace. Patent dated November 20, 1834; expired November 20, 1848.

ALMOND PASTE.—Beat in a mortar 4 ounces of bitter almonds, blanched, with spirit of lavender, or Hungary water, into a very smooth, fine paste; add 1 ounce of honey, ½ ounce of almonds, or orris powder; then beat the whole again.

MISCELLANEA.

SELECT RECIPES, &c.

Black Court or Sticking Plaster.—Take ½ an ounce of benzoin and 6 ounces of rectified spirit; dissolve and strain; then take 1 ounce of isinglass and ½ pint of hot water; dissolve and strain separately from the former. Mix the two, and set them aside to cool, when a jelly will be formed. Warm this jelly, and brush some of it ten or twelve times over a piece of black silk stretched smooth. When this first varnish has become dry finish with a solution of 4 ounces of China turpentine in 6 ounces of tincture of benzoin.

Artificial Asses Milk.—Long experience has demonstrated that for certain purposes the milk of the ass really possesses an efficacy which cows' milk is devoid of. When not procurable it may be imitated as follows:—Boil in 3 pints of water till half wasted 1 ounce each of eryngo-root, pearl barley, sago, and rice; strain, and put a teaspoonful of the mixture into a coffee-cupful of boiling milk, so as to render it of the consistence of cream. Sweeten it with sugar or honey to taste.

Black Drop.—According to Dr. Armstrong the following is the original recipe for this nostrum:—Take ½ a pound of opium sliced and 3 pints of good verjuice, 1½ ounces of nutmegs, and ½ ounce of saffron. Boil to a proper thickness, then add ¼ lb. and two spoonfuls of yeast. Set the whole in a warm place near the fire for six or eight weeks, then in the open air till it becomes a syrup, when it is to be decanted, filtered, and bottled up, with a little sugar added to each bottle. One drop is said to equal three of the tincture of opium of "The London Pharmacopœia." But the statement is of doubtful accuracy.

Noyeau.—Take a gallon and a half of the best French brandy, 6 ounces of French prunes, 2 ounces of celery, 3 ounces of the kernels of apricots, nectarines, or peaches, 1 ounce of bitter almonds, all gently bruised, 2 drachms each of essence of orange and of lemon peel, and ½ pound of loaf sugar; digest for a fortnight, decant, and add as much rose-water as will make up two gallons.

Curaçoa.—Take the peels of 4 Seville or sour oranges, 36 grains of cinnamon, and 26 grains of mace, 1½ pints of brandy, 1 pint of river water, and 1 pound of sugar. Infuse in the brandy for six days the orange-peel, cinnamon, and mace, all previously bruised, distil, and add the water, with the sugar dissolved in it, and filter. According to Dr. Kitchiner, curaçoa may be imitated thus:—Add 2 drachms of sweet oil of orange-peel to 1 pint of the best rectified spirit, then dissolve 1 pound of lump sugar in 1 pint of cold soft water. Of this make a clarified syrup, add the spirit, and agitate. Let it stand till next day, and filter it four times through a funnel lined with muslin and blotting-paper.

Aromatic Vinegar.—Digest in 2 pounds of acetic acid 1 ounce of the dried tops of rosemary, 1 ounce of the dried leaves of sage, ½ ounce of the dried leaves of lavender, ½ ounce of bruised cloves, for seven days. Express the liquor, and filter through paper.

Seidlitz Powders.—Take 2 drachms of potassio-tartrate of soda and 2 scruples of sesquicarbonate of soda. Mix, and dissolve in half a pint of soft water. Then dissolve 35 grains of tartaric acid in q.s. of water, and add this to the former solution. It must be drunk in a state of effervescence. It is a mild cooling purgative, but does not in the least resemble the genuine seidlitz water.

Seltzer Water.—Take 20½ ounces of water, impregnated by the usual apparatus with carbonic acid gas, and dissolve in it 4 grains of carbonate of soda, 2 grains of carbonate of magnesia, and 20 grains of chloride of sodium. It is a mild purgative.

Seidlitz Water.—Take 20½ drachms of water, acidulated in the usual apparatus with thrice its volume of carbonic acid gas, about 2 drachms of sulphate of magnesia, 18 grains of hydrochlorate of magnesia. Dissolve, and bottle for use. If it be wanted stronger, double the quantity of the sulphate and hydrochlorate of magnesia. This is the aqua sedlicensis of "The Paris Codex."

Sodaic Powders consist of ½ drachm of sesquicarbonate of soda in a blue paper, and 25 grains of tartaric, or, better, citric, acid in a white paper. These are dissolved in separate glasses, and mixed at the instant they are to be drank. This differs essentially from common soda-water, being a tartrate of soda with carbonic acid gas diffused through it.

An Illicit Distillery.—On Saturday a seizure of an illicit distillery was made, under rather peculiar circumstances, by the officers of excise, assisted by the police. From information received, Mr. Daniel Colquhoun (supervisor of the Stepney district), with Mr. John Vansome and Mr. Edward Thomas, officers of the same district, accompanied by police-constable 70 H, proceeded to 52, Phœnix-street, Spitalfields. An examination of the exterior of the premises having been made, it was resolved that Mr. Colquhoun and the police-constable should guard the front of the house while Mr. Vansome and Mr. Thomas should endeavour to effect an entrance at the back. A passage separated Nos. 51 and 52, and having forced open a door which led to a large yard at the back, they saw three men rush into it in great haste from No. 52. Mr. Thomas, having satisfied himself that a still was at full work on the premises, called out to Mr. Vansome to secure the gate, and thus prevent the men from escaping. Two of the men made their way to the gate, but found it fastened against them, while the other ran to a wall at the bottom of the yard, followed by Mr. Vansome, up which he climbed with great dexterity, and would have succeeded in completely clearing it, had not Mr. Vansome jumped up and seized him by the legs, nor could oaths or threats induce him to relinquish his hold until the arrival of the police, whom he called to his assistance. In the meantime the other two men, finding their retreat at the back impeded, ran into the house, and thence to the top floor, pursued by Mr. Thomas and a police-constable. The men, thus finding themselves so nearly in the hands of the officers, opened the window, and took really frightful leaps on to an adjoining wall, thence on to some stabling, and, after passing over several other buildings, finally succeeded in making their escape. This dashing and perilous exploit excited the utmost astonishment. The other man having been secured, the officers also gave a woman into custody whom they found on the premises. They then proceeded to search the house, and found in the back room on the ground floor a copper still at full work, running off strong spirits, eighty gallons of prepared spirits, upwards of 100 gallons of molasses, fermented wash ready for distillation, a quantity of yeast, and the usual apparatus employed in this contraband trade. The still, utensils, and spirits, were conveyed to the Excise warehouses in Broad-street; the wash was destroyed. The two prisoners gave the names of William Hopkins and Ann Murdoch. When the male prisoner was being taken into custody, he was followed by some hundreds of the fraternity, and the greatest praise is due to the police-constable for his conduct, as several times a rush was made by the mob for the purpose of effecting a rescue, but a judicious use of the police-constable's staff had the desired effect of preventing them from carrying it into execution. This capture, it is believed, will have the effect of breaking up a company of illicit distillers which, it appears, from books found on the premises, has long existed in the neighbourhood, carrying on their trade to a great extent.—*Globe.*

Navigation of the Dead Sea.—A gentleman of Cheltenham has addressed the following letter to the editor of the *Times*:—"Sir,—I read in your issue of the day before yesterday (the 21st) a short account of Captain Lynch and the American expedition to explore the Dead Sea, from which it would appear that the descent from the Lake of Tiberias to the Dead Sea by the Jordan had now for the first time been accomplished. But, sir, this is not the case. Our gallant countryman, the late Lieutenant Molyneux, of her Majesty's ship Spartan, two years ago conveyed a small boat overland from Caipha to the Lake of Tiberias, and thence by the Jordan to the Dead Sea, upon which he remained two, if not three, days; he then took his boat by Jerusalem to Jaffa. Poor fellow! he died six weeks afterwards at Beyrout of fever contracted during his journey. The difficulties encountered by the American expedition were mere child's play compared to those which poor Molyneux met with and triumphed over. On one occasion the three seamen he had with him were separated from him, and were seized, beaten, and stripped of their arms and clothes by the Arabs, and found their way almost naked and with difficulty to Tiberias. Still Molyneux persevered, although he had literally to fight his way down. When at Jerusalem in April I saw a letter from Captain Lynch, in which he speaks of fully appreciating Molyneux's daring and perseverance, and in which he refers to his having the same Arab pilot who was with Molyneux. I never met Lieutenant Molyneux; but as I thought the impression might go abroad that the Americans were the first to navigate the Jordan between the two lakes, whereas an Englishman had preceded them, I have taken the liberty of troubling you with these few lines. I am, sir, your obedient servant, W. E. E.—Cheltenhem, Nov. 23."

Australian Discoveries.—At the meeting of the Royal Geographical Society which was held on the 27th ult., the secretary read a most interesting paper on the geography of Cochin China, by Dr. Gutzlaff, the celebrated missionary, at the conclusion of which the president informed the meeting that the following letter has been received from the intrepid Australian traveller, Dr. Leichhardt, conveying probably the last accounts that will be received from him until his arrival at Swan River:—

"April 3, 1848, Cogoon.

"I take the last opportunity of giving you an account of my progress. For eleven days we travelled from Mr. Birrell's station, on the Condamine, to Mr. Macpherson's, on Fitzroy-down. Although the country was occasionally very difficult, yet everything went on well. My mules are in excellent order; my companions in excellent spirits. Three of my cattle are footsore, but I shall kill one of them to-night, to lay in a necessary stock of dried beef.

"The Fitzroy-downs, over which I travelled for about twenty-two miles from east to west, is, indeed, a splendid region, and Sir Thomas Mitchell has not exaggerated their beauty in his account. The soil is pebbly and sound, richly grassed, and, to judge from the myale (*acacia pendula*), of most flattering quality. I came right on Mount Abundance, and passed over a gap of it with my whole train. My latitude agreed with Mitchell's. I fear that the absence of water on Fitzroy-downs will render this fine country to a great degree unavailable. I observe the thermometer daily at six a.m. and six p.m., which are the only convenient hours. I have tried the wet thermometer, but I am afraid my observations will be very deficient. I shall, however, improve on them as I proceed. The only serious accident that has happened was the loss of a spade, but we are fortunate enough to repair it at this station, where the superintendent is going to spare us one of his.

"Although the days are still very hot the beautiful clear nights are cool, and benumb the mosquitoes, which have ceased to trouble us. Myriads of flies are the only annoyances we have.

"Seeing how much I have been favoured in my present progress, I am full of hopes that our

Almighty Protector will allow me to bring my darling scheme to a successful termination.

"LUDWIG LEICHHARDT."

In a former letter to Captain Philip King, dated March 20, the doctor says:—

"My intention is to go from the Victoria to the northward, until I come to the decided waters of the Gulf. If I succeed in my task I shall solve three very interesting questions—the northern, north-western, and western water-heads."—*Times.*

BRITANNIA TUBULAR-BRIDGE.—The works of this great structure, which are of twice the stupendous character of those over the river Conway, have been put in full operation, and are already in an advanced state. The platform for this purpose across the Menai Straits alone is half a mile long, and four large tubes, each weighing 1,700 tons, are now nearly completed. Each tube is 472 feet long, and will have to be floated half a mile along the straits, and then raised 106 feet home. The end tubes are also much advanced. The scaffold or platform on which they are being put together is 100 feet high, 230 feet long, and 60 feet brood, capable of sustaining a weight of 1,500 tons on the top. The cast-iron work of the bridge weighs upwards of 2,000 tons, and the chains used for raising it will alone weigh 100 tons. It will be floated on eight pontoons. Two of them are of iron, of 100 feet long, 28 feet broad, 10 feet deep, and capable of carrying 400 tons each. The middle pier, rising out of the water from the Britannia rock, after which the bridge is named, is to be 230 feet high. There are two other piers of the same elevation, and the entire length of the tube-bridge across the straits will be 1,420 feet, or nearly one third of a mile. The entire experiments and processes are under the superintendence of Mr. Edwin Clarke, civil engineer, who is entrusted with them by Mr. Robert Stephenson.

TO CORRESPONDENTS.

"Staite's Electric Light."—Several correspondents desire to communicate with the patentee. Let them address a letter to 14, Pall-mall East.

"Mr. D. Walker" thus addresses us:—"Sir,—Being about to undertake a series of experiments in the solidifying of liquid manure sewage, &c., with a view to render it more portable, and retain its agricultural properties, and not knowing what has been done in this matter, will you be so kind as inform where I am likely to meet with an account of what has been done, or where any papers or articles on the subject occur, or are there any suggestions, which you would be kind enough to offer?"—In the earlier numbers of the *Pharmaceutical Times* some translations on the subject of manures were given from the original treatise of M. Bouchardat on this subject, to which we would refer the inquirer. The journal of the Agricultural Society has also published methods of compounding manures from time to time. For a knowledge of patents which have been taken out for this subject our correspondent may consult Carpmael's "List of Patents," 8vo.

"A Poor Amateur and Constant Reader" should procure Noad's "Treatise on Chemical Analysis," also Fresenius's and Rose's books on the same subject. Neither should he be without Faraday's "Treatise on Manipulation." The mere theoretical portions of chemistry may be learned from either of the prevailing manuals. We prefer Dr. Kane's book on this subject.

"An Original Subscriber, Chichester."—We know of no better work on the subject than Ure's "Chemical Dictionary" (of which a new edition will shortly appear). Our correspondent should also have Ure's "Dictionary of Arts, Manufactures, and Mines," with its Supplement; also Cooley's "Cyclopædia of Practical Receipts." We beg leave to assure our correspondent that we are no vindicators of the *Pharmaceutical Times.*

"J. A., of Peterborough," thus addresses us:—"You will oblige by informing me in the next number of the *Chemical Times* the price of the patent electric lamps giving as much, or rather more, light than an ordinary mould candle for a sitting-room, and whether the expense of lighting be more than that of candles."—Let him address a letter to the patentee at 14, Pall-mall East.

"An Original Subscriber, Holywell," writes as follows:—"I have about three tons of boxwood sawdust going to waste weekly. You would oblige very much if you would assist me with your valuable aid to enable me to turn the article to some profitable use, and if you suggest anything be good enough to give me particulars in the next number of your valuable periodical, of which I am an original subscriber."—Will the writer send us a specimen of the dust? We should like to ascertain its degree of mechanical fineness.

"Mr. E. Hallam, Uxbridge."—Prolonged experience has demonstrated that collodion can best be made without straining, inasmuch as the little filaments of undissolved cotton add to the tenacity of the resulting skin.

A gentleman recently sent us a letter in which a proposal was made relative to some articles on toxicology. We intended to have answered this letter privately, but have mislaid it. Will our correspondent forward us a specimen of his papers?

"A Glasgow Correspondent."—The butter of antimony of the shops is an impure chloride of that metal, prepared as follows:—Boil 20 parts of crude sulphuret of antimony in 200 parts of hydrochloric acid, to which 1 part of nitric acid has been added. A little pernitrate of iron is used to colour it. The pure sesquichloride of butter of antimony is prepared as follows:—Mix 2 parts of metallic antimony with 5 parts of corrosive sublimate; distil from a wide-mouthed retort.

"Mr. Robert Jennings."—Genuine sarsaparilla is covered by a brown or a reddish bark, with a central woody portion, soft, white, and sometimes like starch. This part is useless, the virtues residing in the bitter principle of the bark, and the more it inclines to a red colour it is the richer and more powerful. The grey and dirty brown sorts are not good. The best sort comes from Jamaica and the Brazils, called Lisbon sarsaparilla; the worst from Honduras and Vera Cruz.

"An Amateur Enameller."—The purple precipitate of cassius, or gold purple as it is sometimes called, is a compound oxide produced by mixing solutions of gold and tin. In the arts it affords not a bright but a rich and powerful colour of great durability.

"A Jeweller."—Borax is found native in Persia and Thibet, and imported from India in an impure state under the name of tincal. This is purified by calcining, dissolving, and crystallizing it.

"Hamburg Pickle."—Take 16 quarts of water, 10 pound, of common salt, 6 ounces of saltpetre or nitrate of potass ½ pound of brown sugar; boil and skim, and use for dipping meat in, to make it keep during hot weather. After three weeks boil it again and skim, adding 3 pounds more salt, and two ounces more saltpetre; and after the same time boil it again, and it will keep three months.

"An Assistant."—Sap green is prepared from the juice of buckthorn berries, and being usually kept in bladders is termed bladder green. It ought to be of a dark colour, of a glossy fracture, and transparent. It is used in water-colour painting, but is apt to mildew.

"J. Barton."—It is true that Morison's pills may be said to be of *vegetable* origin, but they are not the less dangerous on that account. There are two sorts of these pills, No. 1 and No. 2. The first are the smallest and darkest coloured, and are composed of bitartrate of potass, aloës, and asafœtida; the second are composed of the same ingredients, with the addition of gamboge.

"Investigator."—The compound sold by druggists as Cheltenham salts, we need scarcely remark, is not produced by evaporating the Cheltenham water. It is composed of 120 grains of sulphate of soda, and 66 grains of sulphate of magnesia, 10 grains of chloride of sodium, ½ grain of sulphate of iron, mixed by trituration in a mortar.

"Carpe diem."—We advise you most strenuously not to accept the office until you have better qualified yourself to discharge efficiently its duties. Come to London and work for three months in the laboratory of the College of Chemistry. You would at the expiration of that time be competent—at present you are not. We speak in kindness.

"A Young Housewife."—The fashion for brown gravies is a most innocent one, which our correspondent need not be inimical to. A very good browning liquor is made as follows:—Beat to powder 4 ounces of white sugar, and put into a very clean iron frying-pan with 1 ounce of fresh butter: mix it well over a clear fire, and as it begins to froth hold it higher up. When it is of a very fine brown pour in by very slow degrees a pint of port wine, stirring it well all the time. Then put in half an ounce each of Jamaica and black pepper, six cloves, six shallots peeled, three blades of mace bruised, three spoonfuls each of mushroom and walnut ketchup, some salt, and the finely pared rind of a lemon. Boil the whole gently for fifteen minutes, pour it into a basin till cold, take off the scum, and bottle it for use.

"A Member of the Pharmaceutical Society."—It would be invidious in us to offer an opinion. Our correspondent should judge for himself.

"N. P. O."—Respectfully declined. The MS. shall be returned.

"Mr. R. Sinclair, Peterborough"—Ambergris comes from Holland, Africa, Brazil, and the East and West Indies, where it is found floating on the sea. That which is grey, very light, and easy to break, is the best; that which is brown or black, heavy, and difficult to break being interior. It is frequently adulterated with wax, storax, gums, and white writing sand, which may be detected by a magnifying-glass, or by thrusting into the pieces a hot needle and observing the odour.

"Mr. Alfred Evans."—The real arrack is an Eastern spirit distilled from palm-juice, also from rice and other grain, but it may be successfully imitated by dissolving 40 grains of benzoic acid in a quart of rum. With this imitation the celebrated Vauxhall punch is made.

"Mr. N. Palmer."—The transparent soap which you so much admire is made by dissolving white soap in alcohol and evaporating carefully.

"Mr. Staniland's" suggestion shall be duly considered.

"Mr. James Horton."—There are two nostrums known as Daffy's Elixir—1 Dicey's Daffy's Elixir; 2. Swinton's Daffy's ditto. We append the formula for each:—Dicey's: Take 4 ounces of senna-leaves, 2 ounces each of rasped guaiac-wood, dried elecampane-root, coriander-seeds, anise-seeds, caraway-seeds, and liquorice-root, 8 ounces of stoned raisins, 6 pints of proof spirit. Digest for a week, strain through bibulous paper, and add half a pound of treacle. Swinton's: Take 3 pounds of jalap-root, 12 ounces of senna-leaves, 4 ounces each of coriander-seed, anise-seed, liquorice-root, and elecampane-root, 1 gallon each of wine and water. Digest for three weeks, strain, and add a gallon of treacle.

"Mr. N. Richardson, Belfast."—Originally the term capillaire was given to the mucilaginous syrup prepared from Adiantum capillus veneris, or true maidenhair; but the syrop de capillaire, as now made, is little else than simple syrup flavoured by orange-flower-water. The following is a good formula:—Take 1 pound of refined sugar in powder, 1 pint of water. Dissolve the sugar in a tinned copper vessel over the fire. When boiling add 1 ounce of the best honey, and 2 ounces of orange-flower-water. Skim, let it cool, and strain through flannel. To be kept in well-stoppered bottles.

"Mr. P. Morton."—At present we know of no situation that would be suitable for you. Should we hear of any your request shall be complied with.

"Mr. Jno. Stanning, Newcastle."—Procure Mitchell's "Manual of Assaying."

"Mr. J. Peat, Duffield, Derbyshire."—Answered at page 50.

"Mr. S. Summers."—The same.

"Wm. Rice and Co., Dublin," should have stated what kind of soot. The amount of contained ammonia is subject to variation.

"A. P. H., of Manchester," is sincerely thanked for his kind remarks.

"Mr. Fred. Beckwith."—The apparatus now generally employed for the oxyhydrogen lights consists of two wedge-shaped macintosh bags, for containing separately two gases, pressure-boards for the same, and a jet in which the gases are allowed to mix just before being burned.

"Mr. J. Foster."—The tables may be procured of Messrs. Horne, Thornthwaite, and Wood, opticians, &c., of Newgate-street, London.

"H. V."—Acetic acid exerts no action upon tin. Collodion is made by dissolving gun-cotton in ether. It is preferable to put into the ether a little more of the gun-cotton than it will perfectly dissolve, the strong filaments of which increase the strength of the resulting plaster.

"Mr. George Overton."—We should imagine that you run no risk. The question, however, is rather legal than chemical.

"E. H."—By treating burnt bones with oil of vitriol.

"Chemicus" should forward us a specimen.

"Mr. Nicholas Paterson."—A considerable amount of platinum is found in the Uralian mountains, but very much contaminated with other metals. In point of fact, the Russian platinum is very seldom pure.

"Mr. James M'Pherson, Glasgow."—Hydrofluoric acid is sometimes recommended for the purpose of graduating glass tubes, but we believe a scratching-diamond, or the angular part of a file newly broken, to be much better adapted for ordinary laboratory use.

"Mr. John Carclew."—We do not know the present yield of the Burra Burra copper mine.

"An Analyst."—It is always unsafe to estimate lead from the data furnished by weighing its sulphuret. It is almost impossible to collect the latter without admixture with traces of free sulphur, which interfere with the result. The usual plan is to convert it into sulphate by digestion with fuming nitric acid. Pale nitric acid will not answer well, inasmuch as the sulphate is not found until after a tediously prolonged digestion.

"Mr. James Hickson."—An answer to your question would involve a prolonged chemical analysis, without which we could not offer an opinion.

"Index."—Orfila has retracted his assertion that arsenic existed normally in the human frame. Had the assertion remained unrepudiated a serious blow would have been struck at the foundation of medico-legal evidence in cases of poisoning by arsenic.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to annual subscribers sending a Post-office order directed to Robert Palmer, or an order on some party in town, for one guinea in advance, which will ensure the journal for twelve months. Half-yearly subscriptions, 13s.; quarterly, 6s. 6d. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—December 2, 1848.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,*
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 30.]

The syrup already concentrated by boiling to the desired extent in the teache or last of the series of boiling-pans,—the skipping-teache, as it is sometimes called, is ladled or skipped, as was observed in the last article, into a shallow wooden vessel termed the cooler. These coolers vary in size from five to ten feet in length, and from three to five fect in width, but scldom deeper than one foot or sixteen inches.

Two skips at least, and usually more, are thrown into each cooler, where they are allowed to remain until the crystallizing or granulating process has set in. The first production of crystals is on the surface, which is broken from time to time and incorporated by stirring with the lower portions of mixture in the cooler.

In these coolers the saccharine mass is allowed to remain until it has acquired a sufficient compactness to admit of its being shovelled into barrels without leaking away into the molasses-cisterns.

From what has already been stated it will be evident that the plan of procedure now detailed is at variance with the conditions laid down as favourable to perfect crystallization. Instcad of attempting to effect the cooling operation with rapidity, every care should be taken to prevent for sometime as much as possible the escape of heat, slow cooling bcing, as we have seen, one of the conditions necessary to the formation of well-defincd crystals. Thus the refiner, as we shall hereafter see, actually increases the temperature of his granular syrup as it comes from the vacuum-pan at a temperature of about 140° up to a temperature of 176° Fahrenheit, or thereabout, by putting it into a copper vessel surrounded by a steam-jacket. This contrivance is usually out of thc power of the colonial sugar-producer to adopt, but he might make a very near approach to the conditions furnished by this refining process by abolishing the shallow coolers and employing in their place large cones or bins with perforated bottoms, these perforations being stopped by plugs. There are those who, not apprcciating the difference between the sugar-refiner and the sugar-maker, have recommended the employment for effecting the process of crystallization and drainage of those small cones in which the refiners make their loaves. For this there is no reason whatever. As long as the refiner is required to send out his staplc in the form of loaves and lumps of definite sizes, so long will he be limited to cones of the corresponding size, but the colonial sugar-producer is actuated by other views. He does not require to make loaves, but only to obtain the practical maximum of dry and finely-crystallized sugar. Therefore, even supposing he had the enormous floorage space which we find in refineries,—even supposing the outlay of the necessary largc stock of moulds of no consideration,—still large cones would be infinitely more desirable, were it merely that they cool down to the circumambient temperature with a degree of slowness proportionate to their size. These cones may be made of iron painted or of wood; indeed the cone form may be departed from, and casks with perforated bottoms, each perforation stopped with plugs, made to answcr exceedingly well.

Reverting to the colonial shallow coolers, the accreted sugar, as has been remarked, is shovelled into buckets and carried to the curing-house, where it is thrown into casks. The object should have becn to leave in the cooler or crystallizing vessel a well-defined crystalline mass, associated with a light-coloured syrup or mother liquor, easily removable by the process of drainage. It need hardly be intimated that by the plan described this desirable result cannot be obtained. Nay, farther, any one at all conversant with the circumstances on which crystallization is dependent would infer, on reviewing the steps of the colonial *cooling operation*, that perfect crystallization was a thing to bc avoided! "Had a planter," remarks a modern author* on the sugar manufacture, "intended to convert the cane-juice into dough or birdlime, he could scarcely have invented a more successful method of accomplishing his purpose; but to obtain sugar a more ill-judged method, or one more defective in principle, could not well be employed."

The accreted mass, as it comes from the shallow coolers just described, consists of crystals of sugar, generally small, mixed with portions of non-crystallized concrete, and with more or less of a fluid syrup of a colour varying from light yellow up to dark brown. This syrup is of very compound nature, containing:—1. A portion of cane-sugar ready to crystallize, but prevented doing so by too rapid cooling. 2. A portion of glucose, or grape-sugar, into which a corresponding portion of the cane-sugar had been changed by the injurious agency of heat and lime. 3. Melasinic, sacchulmic, and sacchumic acids; also sacchulmine and sacchumine; besides other dark bodies, as yet imperfectly examined; bodies which are to be considered the derivates of sugar injured by hcat, lime, and other impurities.

This imperfectly crystalline mass having been put into the casks, from which all the leakage drops into the molasses-tank, a certain drainage, varying in extent according to temperature, amount of crystalline matter, and dimensions of crystals, ensues. The drainage, however, is so far from perfect that the loss by leakage during the voyage home is something enormous; indeed, many samples of badly-cured colonial sugar remain so wet after all the prolonged drainage that they can only be smuggled, to use the expression, into the market by admixture with other sugars.

In order to facilitate this process of drainage or curing, machines have been largely employed in some of the colonies for removing the non-crystallized syrup (molasses) by a process of suction.

This is accomplished by the ingenious and expensive machines termed pneumatic-chests. These vary in their construction in some respects, but the average is as follows:—A chest is supplied with a false bottom, made of finely-perforated metal, of cane wickerwork, or some other material of equivalent effect. Under this false bottom there is a chamber, in which a tendency to a vacuum may be created by the working of a powerful air-pump. The operation of such a machine is obvious. If the crystallized mass admixed with syrup (molasses) be thrown upon the false bottom, and the pump worked, it is obvious that a tendency will be created for thc mass to become drained. Practically, however, the result is this:—If the sugar have been cooled, as is usual in most of our colonies,—if, instead of being obtained in large crystals, it constitutes an amorphous pasty mass, as is too frequently the case,—then a pneumatic-chest will not only draw off the uncrystallized matter, but also a large portion of the smaller crystals, thus diminishing considerably the ultimate amount of sugar. These are unfortunatcly the conditions under which the pneumatic-chest is employed.

It may be answered that the pneumatic-chest is not intended to effect impossibilities; that the proper crystallization of the sugar to be exposed to the action is a thing assumed. Granted; but, if sugar be properly crystallized from a juice properly defecated, it drains perfectly well without any mechanical aid whatever.

Having thus traced the sugar to the cask after the prosecution of the ordinary colonial method of manufacture, it may be thought by some that I have presented the operation in its most barbarous shape, totally omitting a large number of mechanical ingenuities which have been introduced from time to time for the purpose of improving the quality or increasing the quantity of the resulting sugar. These omissions have been purposely made, not out of levity or disrespect to the inventors, but owing to the conviction with which I am impressed that many ingenious mechanical contrivances have been deprived of their value by the circumstance that they were called upon to operate upon an imperfectly purified juice. Even the vacuum-pan, when placed under the management of parties perfectly competent to work it, has not, for this reason, given universal satisfaction.

The injurious effect of heat alone on ever so pure a solution of sugar and water will bc recognised by all observers who devote the requisite attention to the operation; but it is a fallacy from which the colonial sugar-manufacturer has greatly suffered to imagine that the primary object to be achieved is the reduction of the amount of heat during the process of evaporation to its lowest limits. That such reduction alone is not enough is demonstrated on those estates where not only one vacuum-pan is employed corresponding to the skipping-teache, and merely used to complete the evaporation process, but where the juice is passed through a series of vacuum-pans, without the least exposure to the open fire. Now, it is conceded on all sides that by means of the vacuum-pans the injurious agency of heat is reduced to its lowest practical limits, and yet the result has been productive of disappointment whenever the juice did not happen to have been defecated or separated from its accompanying impurities with extreme care. This circumstance plainly demonstrates that no appliance for effecting evaporation at low temperatures can be of much avail if made to act upon an impure juice. A means, therefore, of effecting thorough defecation or purification is the starting point of all improvements in the sugar manufacture. Most of the colonial, at least West Indian, plants are very improperly constructed. Instead of the bottom merely of each boiling-pan being exposed to the agency of the flame, these pans are so decply set that the flame plays around their sides, and immediately burns or blackens any of the syrup with which the sides may from time to time come in contact. As this danger of burning increases with the density of the syrup, it is evident that the destruction from this cause is chiefly incurred in the teache, or last boiling-pan.

Various plans have been had recourse to with the view of obviating this source of injury: the most obvious one was to use pans of flatter bottoms, and to reset them in such a manner that the fire should no longer play over their sides. Accordingly this has been done of late in most of the new plants. To avoid the necessity of ladling, moreover, from pan to pan, the newest boiling ranges or batteries have their pans supplied with valves to open and shut at pleasurc. Instead, moreover, of skipping by thc ladle out of the teache, an ingenious apparatus, called a skipper, is now occasionally employed. It consists of a hollow cone fitting into the teache, and supplied underneath with a valve that rises internally. This skipper being lowered into the teache by a crane, the valve opens, and the vessel becomes charged with syrup. By means of the crane it is now elevated, and thus all the syrup contained in the teache removed at once. By this contrivance it was assumed that much of the burning which usually occurs to the sugar from the great heat of the teache might be avoided, but the result has been by no means satisfactory. In furtherance of the same object there have been constructed in some of the French colonies skipping-teaches, made like coal-scuttles in shape, and which may be so tilted up by means of powerful leverage that the contained syrup shall be turned out. This kind of teache is called *a bas cule*.

Some sugar-producers, with an instinctive fear of open fire-boiling, have actually gone to the expense of boiling by steam under the ordinary atmospheric pressure. The fallacy of this is manifest; to boil under the ordinary atmospheric pressure a certain definite temperature is re-

* Dr. Muspratt's Lecture next week.

* Dr, Evans.

quired, and, whether imparted by steam or by flame (properly applied), still the resulting amount of injury must be equal. Thus all the extra expense of steam is encountered without any of the advantages of steam-boiling in vacuo.

The subject of filtration of the juice at the proper stage and under proper circumstances will come specially under our view hereafter, in connection with improved means of purification or defecation; but in this place may with propriety be adverted to in few words the process of non-chemical filtration of the recent juice, or of juice which has been treated with lime. The juice, as it comes from the mill, contains a considerable amount of mechanical impurities, in the form of broken tissues both of stems and leaves, which it has occurred to some that if separated the resulting produce would be much more pure; with this intent many filtering materials of mechanical nature have been tried, but with universal dissatisfaction; the fact being, that neither sugar cane-juice nor any other raw vegetable juice will readily pass through filtering tissues, on account of the albuminous and coagulable matter contained; therefore the most fallacious notions concerning the possibility of filtration of cane-juice under any circumstances have been adopted by the colonial sugar-growers. Raw cane-juice should not be filtered at all—should not be attempted to be filtered: not only will the process be ineligible on account of the prolonged time, but also, on account of the unseparated chemical impurities contained in it, the juice will turn sour and ferment under the process. A rough straining through a series of wire sieves is all the mechanical separative treatment that the juice should be exposed to in this stage.

Is filtration through textures a profitable operation to succeed defecation by lime? This is a much-agitated question, which is only to be decided by a consideration of the amount of benefit gained.

In the ordinary process of defecating by lime the heat applied to the liquor to be purified is never allowed to be sufficient for boiling. The reason for this treatment will be evident when it is considered that the act of boiling would disturb the vegetable crust caused by the lime, and which it is the object of the manufacturer to remove by the process of skimming. It is proved, however, that no less than the boiling temperature is sufficient to ensure the greatest amount of coagulation which lime can effect; therefore, if boiling be produced, and the scum once broken, filtration should be had recourse to, in order to separate the impurities now disseminated throughout the liquid. Carrying out this object, bag filters have been introduced, and, doubtless, with an ameliorative result, but to how little an extent may be judged of when we consider that not the most perfect mechanical filtration through tissues will prevent the subsequent rising of scum when the filtered liquid is boiled. The utmost that can be said of filtration, then, in this stage, and under the circumstances detailed, is, that it is a step in the right direction; but it cannot be too often repeated that no kind of filtration will be of great avail until some means have been devised of defecating the juice much more perfectly than can be effected by lime.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmaeien-en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXV.

(LECTURE LXIII.)

FATS AND FIXED OILS—(*Continued*).

SECTION II.

SUBSTANCES IN WHICH THE FATTY MATTER IS ASSOCIATED WITH SOME ACTIVE PRINCIPLE—(*Continued*).

CROTON TIGLIUM.

The seeds of Croton tiglium have been frequently confounded, hitherto, with those of Jatropha Curcas, which are much less active.

The real croton seeds were analyzed first by Pelletier and Caventou, who discovered in them a highly acrid volatile acid. Brandes has examined them since more minutely. He found in them—

Crotonic acid,
A brownish-coloured oil,
Resin,
A white fatty matter,
A brownish substance,
Gelatinous matter,
Crotonin,
Gum,
Vegetable albumen.

Crotonic acid is a volatile, excessively acrid substance. It is unquestionably one of the active principles of the oil, yet not sufficiently energetic (according to Pelletier and Caventou) to justify its being considered the sole and exclusive source of the medicinal properties of the latter. It volatilizes at abont 34 or 35° Fahrenheit, with emission of highly acrid vapours.

Crotonic acid exists ready formed in the croton seeds, but it appears that an additional quantity of it is generated upon the saponification of croton oil. Brandes assumes that the seeds contain a species of ethereal oil of excessive acridity, and that this oil, by the joint action of air and water, may be transformed into crotonic acid; he founds this assumption principally upon the two following circumstances:—

1. If the distillate obtained from croton seeds is tested immediately after distillation, and subsequently tested again next morning, it is found to have acquired in the meantime a much higher degree of acidity than it possessed at first.

2. If the distilling vapours be received in a solution of potass, they will, at least, partly traverse the solution and diffuse in the laboratory, which, of course, could not be the case were the vapours acid.

The brownish-coloured oil found in croton seeds contains crotonic acid; its composition is probably rather complex.

The white fatty matter is a species of soft stearine.

The brownish substance is soluble in water and in alcohol; when treated with acids it yields crotonic acid, and there can be no doubt but that it is a mixture of divers substances.

The gelatinous matter appears to have the greatest analogy with the gliadine or vegetable gelatine extracted from gluten.

The resin is of a light brown colour, and soft consistence. It has a disagreeable smell, owing, doubtlessly, to the oil which it retains. It is soluble in alcohol, insoluble in water and in ether. The alkalis dissolve it, with separation of a whitish matter. The purgative properties of the oil are (as already stated) not attributable solely to the crotonic acid, but may partly be ascribed also to the presence of the resin.

The substance, called by Brandes crotonin, and regarded by that chemist as a vegeto-alkali, appears to me simply a compound of magnesia with a fatty acid.

The seeds of croton tiglium are excessively acrid; they should be handled with great caution. Even with the utmost care it is very difficult to guard against accidents, if the quantity of oil to be prepared is anything like considerable. The acrid emanations proceeding from the seeds determine on the skin a more or less severe erysipelatous inflammation.

CROTON OIL.

Croton oil has a brown colour, and an exceedingly disagreeable smell. Its acridity is excessive; at the dose of one to two drops it is one of the most violent purgatives,

The following is the best method of extracting the oil from the seeds:—

Grind the croton seeds in the mill,* put the powder into a ticking bag, and press between two heated iron plates. Let the expressed oil stand for a fortnight; decant and filter.

Pound the residuary mass (left in the ticking bag); put it into a close-covered stew-pan together with an equal weight of rectified alcohol; heat in the water-bath to 122°, 130°, or 140° Fahr.; pour the contents of the pan subsequently on a piece of ticking, and subject to the action of the press.

This part of the operation more particularly requires the utmost caution; even the most expert operator will find it exceedingly difficult to guard against contact with the acrid vapours.

Distil the expressed alcoholic liquid in the water-bath, to drive off the alcohol (which will answer for a new operation), and let the residuary thick oil stand at rest for a fortnight. Decant the oil off from the sediment, and filter the decanted liquid in a hot stove. Add the filtrate to the product of the first operation.

The first operation might be altogether omitted, and the pounded seeds treated at once with alcohol; in that case, however, a larger portion of alcohol would, of course, be required, and the quantity of matter to be operated upon would be necessarily much larger, which, again, would increase the chances of accident.

The less or greater advantages and economy derivable from the second operation (extraction with alcohol) depend upon the greater or less power of the press which the operator may happen to have at his disposal.

I obtained from 1 kilogramme of croton seeds 270 grammes of oil, viz., 146 by the simple action of the press, and 124 by the extraction of the grounds with alcohol.

That a certain amount of crotonic acid is carried away with the alcohol when the latter is distilled off the mixture of oil and alcohol is unquestionable, and accordingly it would appear that the oil obtained by extraction with alcohol must necessarily be an inferior product as regards its medicinal properties. This is, however, by no means the case, as the alcoholic extract contains, on the other hand, a larger share of resin than the cold-pressed oil, which compensates for the loss of crotonic acid. Comparative therapeutic experiments made by M. Piedagnel have fully proved that the medicinal efficacy of the product extracted by means of alcohol is perfectly equal to that of the cold-pressed oil.

ALCOHOLIC TINCTURE OF CROTON.

Take of Croton oil, 1 drop.
Alcohol of 88 C. (34° Cartier), 2 grammes.

Or,

Take of Croton seeds, freed from the husks, 1 part.
Alcohol of 88 C. (34° Cartier), 12 parts.

F.S.A.—(Pope.)

One gramme of the latter tincture contains about twenty centigrammes of croton oil.

SACCHAROLATE OF CROTON OIL.

Take of Croton oil, 1 drop.
Elæosaccharum of cinnamon, 4 grms.

Mix.

PASTILS OF CROTON OIL.

Take of Chocolate (flavoured with vanilla), 8 grammes.
Sugar, 4 grammes.
Starch, 1 gramme.
Croton oil, 5 drops.

Mix the oil thoroughly with the sugar and starch, and incorporate the mixed mass with the chocolate. Make into pills to the number of thirty, and flatten them into pastil-shape upon a heated tin plate. Each of the thirty pastils contains the one sixth part of a drop of croton oil.

DR. CORY'S PURGATIVE POTION.

Take of Croton oil, 2 drops.
White sugar, 8 grammes.
Gum arabic, 2 grammes.
Peppermint-water, 32 grammes.

Misce secundum artem.

Dose, one dessertspoonful every three or four hours until the desired effect is produced.

* The advantages that would result from the previous removal of the husks are not of sufficient importance to compensate for the additional risk of accidents to which the close handling of the seeds would necessarily expose the operator.

Patients take this potion without the slightest aversion.

CROTON-OIL PILLS.

Take of Croton oil, 1 drop.
Conserve of roses, 1 decigramme.
Powder of marshmallows, a sufficiency.
To form one pill.

SOAP PILLS OF CROTON OIL.

Take of Croton oil, 2 parts.
Soapboiler's lye, 1 part.
Mix. This mixture will speedily acquire sufficient consistence to be rolled into pills.

Each pill contains the one third of its own weight of croton oil.

CROTON-OIL LINIMENT.

Take of Croton oil, 1 part.
Olive oil, 5 parts.
Mix.

This liniment is used advantageously as a revulsive. Rubbed into the skin three or four times per day, it produces redness of the frictioned part, succeeded by an eruption of small pustules; at the end of a few days a yellowish liquid oozes from these pustules, after which the skin returns to its natural state.

EUPHORBIA LATHYRIS.

(SPURGE.)

I have analyzed the seeds of Euphorbia lathyris. I found in them—

A yellow-coloured fixed oil,
Stearine,
A brown-coloured acrid oil,
A crystalline matter,
A brown resin,
An extractive colouring matter,
Vegetable albumen.

The stearine is white and insipid.

The yellow-coloured oil has purgative properties, which it owes, however, unquestionably to certain extraneous matters held in solution by it.

The brown-coloured acrid oil seems to be the true active principle. This oil has a disagreeable smell and flavour; it dissolves very readily in alcohol and in ether.

The crystalline matter has been hardly examined yet; it has neither smell nor taste; it crystallizes in needles, and dissolves readily in alcohol and ether.

The resin is of a dark brown colour, approaching to black; it is insipid, fusible, soluble in the oils, sparingly soluble in ether, but insoluble in water and in alcohol, no matter whether cold or boiling.

The oil of euphorbia lathyris may be prepared by either of the three following processes:—

1. Simple expression.
2. Extraction by alcohol.
3. Extraction by ether.

1. SIMPLE EXPRESSION.

Pound or grind the spurge seeds, put the pounded or ground mass into a ticking bag, and subject to the action of the press. Filter the product. The oil obtained by this process is highly fluid, of light yellow colour and acrid taste. It is not soluble in alcohol.

2. EXTRACTION BY ALCOHOL.

Grind the spurge seeds, mix the powder with twice its weight of alcohol, and heat the mixture in the water-bath to from 122° to 140° Fahrenheit, stirring occasionally. Strain hot, and subject the grounds to the action of the press. Distil the product in order to remove the alcohol. (The liquid which runs from under the press forms two layers, of which the upper one consists of an alcoholic solution of oil and resin, the lower one simply of oil which the alcohol has failed to dissolve, and which subsequently, after the expulsion of the alcohol, mixes with the oil and resin that were held in solution by that menstruum.) Let the oil stand at rest for a few days, and filter.

The oil obtained by this process is yellowish-brown, and thicker than that obtained by simple expression. It is likewise more active than the latter. Given at the same dose (1½ to 2 grammes), it produces greater nausea, more violent colics, and more copious evacuations.

3. EXTRACTION BY ETHER.

Grind the spurge seeds, place the powder into a Robiquet's funnel, and lixiviate with ether, displacing the last portions of that solvent by means of water. Distil the ethereal liquid in order to drive off the ether. Let the residuary oil stand at rest for a few days, and filter. The product obtained by this process is thicker and darker coloured than that obtained by simple expression; it is not, however, quite so dark coloured as that obtained by means of alcohol.

M. Martin Solon states that its purgative power is equal to that of the alcohol-extracted oil, but that it causes less nausea than the latter. At a dose of six grammes it acts as an emeto-cathartic and hydragogue. Spurge oil may be easily given by itself, or in a mucilaginous potion.

LOZENGES OF SPURGE OIL.

Take of Chocolate (flavoured with vanilla), 8 grammes.
Sugar, 4 grammes.
Starch, 1 gramme.
Cinnamon in powder, 50 centigrammes.
Spurge oil, 30 drops.

Triturate the oil with the sugar and starch, and incorporate the powder with the chocolate. Divide the mass into 30 pills, and flatten the latter into the shape of lozenges upon a hot tin plate.

Each of the 30 lozenges contains one drop of spurge oil.

COD AND RAY LIVER OIL.

The cod liver oil is extracted in Holland and in the north of Europe (particularly in Norway) from the liver of several species of fishes belonging to the genus Gadus, and more especially from the liver of the Gadus merlucius. At Antwerp they use the liver of the Raja Pastinaca (the sharp-fronted ray). The livers are exposed to the heat of the sun (in bladders), and the oily part is removed as it separates. The oil is also extracted with the aid of heat. According to M. Jongh the livers are heaped up in tubs; the white oil separates first, the brown oil at a later period—both spontaneously. The black oil is found floating on the surface of the water in which the livers are boiled after the separation of the white and brown oils.

Cod liver oil has a strong smell, resembling that of pickled anchovies; it is insipid, and leaves in the mouth a disagreeable fishy taste.

It is highly probable that cod liver oil contains phocenine, an odorant neutral oil, which may be looked upon as a compound of glycerine and phocenic acid, a fatty volatile oil of strong odour.

Notwithstanding the disagreeable smell and taste of cod liver oil, children take this medicine without aversion.

Cod liver oil enjoys a high and well-deserved reputation as an efficacious remedy in scrofula, the rickets, tubercular consumption, &c.

The best way to administer both cod liver and ray liver oil is in the pure state, in doses of from one teaspoonful to one tablespoonsful, morning and night.

According to Jongh's analysis, cod liver oil contains—

Olcïne,
Margarine,
Butyric acid,
Acetic acid,
Part of the products of the bile,
Gaduine,
Iodine, bromine, chlorine, and phosphorus.

Gaduine is a colouring matter which appears at first yellow, but acquires afterwards upon exposure to the air a deeper tint. It is soluble in the alkalis.

The remarkable medicinal properties of cod liver oil are fully accounted for by the presence of the iodine, bromine, chlorine, and phosphorus.

The absolute proportions of these four elements vary in different sorts of oil (the white, brown, and black), but their relative proportions are invariably the same. According to Jongh, the white oil is the richest of the three in iodine, bromine, chlorine, and phosphorus; and the brown oil again is richer in these elements than the black oil.

Ray liver oil, according to MM. Girardin and Presser, contains a larger proportion of iodine than cod liver oil.

The use of ray liver oil affords this great advantage over that of cod liver oil, that the apothecary may ensure the purity of the former, by preparing it himself, whereas he can never rely upon the purity of the cod liver oil usually sold by the trade.

Ray liver oil may be prepared either by boiling the livers in water and skimming off the oil as it rises to the surface, or by the following process, recommended by M. Gobley:—

Detach the membranes which adhere to the liver, and cut the latter into thin slices. Put the slices in a pan, place the latter on a moderate fire, and keep boiling gently until the oil has separated from the membranous lumps. Strain through a woollen cloth with gentle pressure. Let the oil stand at rest for a few days, and filter through paper to separate the fluid gold-coloured oil from the concrete white deposit which has subsided.

The liver of the ray yields about the one fourth of its weight of oil.

The oil obtained by boiling the livers in water is of a light yellow colour.

POTION OF COD OR RAY LIVER OIL.

Take of Cod or ray liver oil, 90 grammes.
Gum arabic, 15 grammes.
Water,
Syrup of opium, of each 60 grammes.
F.S.A.

M. Rayer gives this potion in nine doses, three per diem, in cases of chronic pneumonia and chronic gastritis.

SYRUP OF COD OR RAY LIVER OIL.

Take of Sugar, 12 parts.
Bitter almonds,
Gum arabic, in powder, of each 1 part.
Cod or ray liver oil, 2 parts.
Pure water, 6 parts.

Pound the almonds with the gum and about 50 grammes of sugar, add gradually the oil mixed previously with about 100 grammes of water, and beat the mixture up thoroughly; add now the remainder of the water intended for the syrup. Strain the emulsive liquid through a cloth, and melt in the strained fluid the remainder of the sugar, at a heat not exceeding 104° Fahrenheit: were the temperature raised higher than 104°, the albumen of the almonds would coagulate and thus spoil the product.

BUFELD'S POMATUM OF COD OR RAY LIVER OIL.

Take of Cod or ray liver oil, 15 parts.
Liquid subacetate of lead, 8 parts.
Egg yolk, 12 parts.
Mix.

Dr. Bufeld uses this ointment to dress consecutive scrofulous ulcers, in the case of inflammation and suppuration of the lymphatic ganglions.

SOAP OF COD OR RAY LIVER OIL.

Take of Cod or ray liver oil, 2 parts.
Caustic soda, 1 part.

Mix the soda gradually with the oil, and run the mixed mass into moulds as soon as it has acquired sufficient consistence for that operation.

M. Deschamps d'Avallon uses this soap as the basis of cod liver oil pills; he prepares also with it a cod liver oil balsam by dissolving it in an equal weight of alcohol of 98 C. It is by no means certain, however, whether the saponification leaves the medicinal properties of the oil intact.

FRENCH HUNGARY WATER is made from the rosemary flowers alone, and is much superior to any that is made in England.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

M. BARRET ON THE CHEMICAL EQUILIBRIUM OF THE HUMAN BODY.

The object proposed to himself by this philosopher was to ascertain by a direct examination of the aliment and the egesta of man the following problem:—"Given the amount and the elementary composition of aliments, solid as well as liquid, taken into the body each day, to establish the amount and the elementary composition of the different evacuations, transpirations, and excretions in such a manner that an equation may be formed of the total gain and loss of the human body."

The following are the conclusions:—

1. That, for the carbon consumed each day by the oxygen of respiration, results are obtained identical in proportion with those arrived at in another manner by M. Andral and Gavarnet. But to the cause of variation indicated by these authors another must be added, viz.:—The quantity of carbon consumed in the winter is about one fifth greater than that consumed in summer.

2. That the amount of nitrogen contained in the aliments is greater than that contained in the evacuations, so that a portion of this gas must be evolved in the perspiration. This portion amounts to the third or fourth part of nitrogen taken into the body, but it is only the hundredth part of the carbonic acid produced. In a normal state of assimilation, the ratio of carbon to nitrogen is as 100 to 8.

3. That the hydrogen and oxygen are not found in the necessary proportions to form water; there being always in the aliments an excess of hydrogen, which may be regarded as being partly burned by union with oxygen during the act of respiration. The mean quantity of hydrogen thus burned is the equivalent one third of the carbon transformed into carbonic acid. This hydrogen so burned during the act of respiration is not all the hydrogen of the aliments; the evacuations being more rich than the aliments in hydrogen in the ratio of about 8 to 5.

4. The oxygen which remains, to transform into carbonic acid and water the carbon and hydrogen of the aliments during the process of respiration, is to the total amount of the ingesta in the ratio of 1 to 3.

5. The water both naturally existant and formed artificially during respiration and digestion is (in the mean) 1-67th per cent. of the alimentary ingesta, augmented by the amount of the atmospheric oxygen which enters into combination with the latter.

6. The water of perspiration is in general a little more than that of the evacuations. Nevertheless, in the case of an old man, the transpired water was found to be reduced in amount to one third that of the urine and excrements.

As the result of two experiments more chlorine was found in the aliments than in the evacuations. As the result of two more experiments a very small excess of chlorine was found in the evacuations. A certain portion of chloride of sodium, amounting in some cases to a third of the quantity, does not leave the body by the evacuations. This result was especially evident after a bath had been taken.

7. The equation of the chemical equilibrium of the human body may be written as follows:—

Entry = 100 =		Exit.			
Aliments, Solid and Liquid.	Oxygen.	Water of Perspiration.	Carbonic Acid.	Evacuations.	Other Losses.
74.4	25.6	34.8	30.2		

In general the perspiration is to the evacuations in the ratio of 2 to 1. An exception was found in the case of an old man in whom the evacuations were much greater in amount than the perspiration.

8. Subtracting from the total amount of heat produced each day the heat absorbed by evaporation, and the cutaneous transpiration, as well as the heat removed by expiration, and that lost in the aliments and evacuations, it was found by calculation that the mean temperature lost by radiation is as 30,000 in the summer to 42,000 in the winter per day, or as 1,250 to 1,750 per hour. The following equation may be made between the heat disengaged or gained by the body and the heat lost:—

Heat disengaged.		Heat lost by Evaporation of the Water of Perspiration.	Heat conveyed away by the Air of Respiration.	Heat taken in by the Alimentary Ingesta.	Heat lost by the Evacuations.	Heat lost by Radiation and Contact.
100	=	24.7	+ 7.3	+ 2.2	+ 1.8	+ 64.6

—*Comptes Rendus de l'Acad. des Sciences*, tome xxvii., No. 15, Oct., 1848.

MULDER'S RESEARCHES ON BILE.

Amongst the subjects of chemical research indicated by Liebig is an inquiry of Berzelius's relative to the constituents of ox bile. Liebig's rich imagination created soon another kind of bile, which he described as a most simple compound, consisting principally of a solution of a salt of soda with an organic acid, styled by him cholic acid; and there were soon pupils found at Giessen who, by experiments at Liebig's laboratory, proved the error and fallacy of Berzelius and the correctness of the views of their master.

The great difficulties attendant upon the analysis of fresh bile left Berzelius no hope of seeing Liebig's error exposed during his lifetime, when suddenly, by the researches of Mulder, to whom organic chemistry, and more especially that of the animal kingdom, is so much indebted, a light was thrown on this subject which decided the matter beyond question, and confirmed the opinion of Berzelius.

From Mulder's experiments it appears that the bile contains ingredients which are accessory, others which vary much; but only one principal constituent. The accessory parts are chiefly the following bodies:—Sulphates, phosphates, and carbonates of alkalis; cholesterine, fat, combinations of lipyloxide, of margaric acid, and stearic and oleic acid; also a species of soap of the same acids and alkalis; two colouring substances, biliverdin and bilifulvin; some fibrous (carneous) extract; and small quantities of other matters.

Those constituents which vary in quality are sometimes numerous, and consist of resinous acids; fellic and cholic acids, combined with soda and ammonia, so as to form soluble salts, and lastly of *taurin*.

The chief constituent of ox bile is a single extractive-like substance called *bilin:* it has a sweetish-bitter taste, is soluble in water and alcohol, insoluble in ether, and consists of carbon, hydrogen, azote, sulphur, and oxygen. It has a remarkable tendency to be decomposed, whereby it gives rise to the production of many substances which vary in quantity. The knowledge of this principal constituent involves the true knowledge of the bile, and throws a clear light upon its chemical and physiological efficiency in the animal economy.

Bilin is the substance produced and secreted by the liver; it forms the greatest part of all compounds met with in the bile; but its great propensity to undergo changes is the cause of its producing other substances (varying in quantity) whenever the bile has been retained a longer or shorter period within the gall-bladder; the bile, then, in such cases does not merely contain bilin, but also combinations of it with fellic and cholic acids, and the other substances simultaneously formed, viz., ammonia and tannin, but, as far as is known, contains no other substance. The transformation of bilin is continually going on in the gall-bladder and in the intestinal canal, just as if bile were preserved without the animal economy, whether in continued contact with the atmosphere or not, at a low or high temperature; but within the animal economy the transformation is principally effected by the process of digestion.

The same may be effected by strong exsiccation or the influence of acids. The substances produced by this decomposition are ammonia, taurin, and either the resinoid acids mentioned above, or four others, that is, fellanic and cholanic acid, dyslisyn, and cholic acid.* The fellic and cholic acid differ only by their unequal proportion of hydrogen and oxygen.

The fact of there being commonly found in the fresh bile combinations of bilin and fellic and cholic acid gave rise to their being considered as one substance, styled cholic acid; but, when the combination is freed from fat and other extraneous admixtures, it may be decomposed into three substances, namely, into bilin, fellic and cholic acid.

Dyslisyn, the last product obtained by the decomposition of bile or bilin, by boiling it with hydrochloric acid, is insoluble in alcohol; soluble in ether; and forms a pulverulent substance.

Physiological Views.—The important agency of bile in the animal economy is owing to the great tendency which bilin has of undergoing continual changes. In many animals the bile is poured out into the duodenum, and from this moment suffers continual changes; that is to say, in proportion as the quantity of bilin decreases, fellic and cholic acid increase, and enter into combination with the ammonia which is produced by the change; also with the soda contained in the bile, most probably as a carbonate. After this, the bile is at no place of the intestinal canal found to be of the same quality, for the further down it proceeds the more does it form fellic and cholic acid, ammonia, and taurin, until ultimately there exists no trace of bilin in it. Of the bile itself probably nothing returns into the vascular system; or, if any part of it does so return, it is not in the form of bilin. The stimulus of the bile is different for each particular part of the intestinal canal, and so *vice versâ* is the influence exercised on the bile by each portion of the canal; and it is interesting to observe how many changes and how many substances are produced by a single organic substance (the bilin) as the principal constituent of bile.—*Jahres Berriht über die Fortschritte der Chemie und Mineralogie von Jacob Berzelius to the Swedish Academy of Sciences.*

RESEARCHES ON THE COMBINATIONS OF SILICIUM.

By M. ISIDORE PIERRE.

Silicic acid is so widely distributed throughout nature, constituting so large a part and so great a number of compounds which are disseminated in almost all geographical formations, that all which relates to the study of those properties must necessarily interest the chemist, the mineralogist, and the geologist.

Thus at different epochs we have seen the most distinguished chemists occupy themselves by the study of the compounds of silicium, and especially of silicic acid.

Notwithstanding the numerous works—notwithstanding the well-known competence of the various authors who have devoted themselves to this subject—the chemical history of the combinations of silicium leaves much to be yet desired, as will be evident on comparing the various opinions of different authors who have written on this important subject.

Hitherto chemists have not even agreed to the

* Fellansäure, cholansäure, dyslisyn, and cholsäure.

formula of the chloride of silicium. Some admit that the silicic acid ought to be represented by the following formula :—

$$Si. O^3,$$

and they call the atomic number of silicium 266.82.

Others admit the formula, $S^2 O^2$, taken for the atomic number of silicium 177.88.

In short, according to the opinions of other chemists, the natural formula of silicic acid ought to be Si O, and the equivalents of silicium S = 88.94.

Each of these three formulæ has been adopted by chemists of illustrious fame, and this latter circumstance is in itself of a nature to increase the uncertainty.

The first of these formulæ, admitted by the majority of mineralogists, is backed up by the authority of Berzelius and Thénard.

The formula,

$$Si O^2,$$

admitted by a certain number of chemists and mineralogists in Germany, amongst whom may be noted M. Gmelin, has the advantage, according to M. Cahours, of reducing within the ordinary conditions the volume of vapour which represents the equivalent of the *proto-silicate of ethule* of M. Ebelman.

In short, the formula, Si O, seems to be now admitted by the greater number of chemists in France. It was first proposed by M. Dumas long ago, when he published his excellent work upon the specific gravity of vapours.

M. Ebelman, in his interesting memoir upon silicic ether, adopted this latter opinion after a long and searching discussion on the matter.

Inasmuch as, in the opinion of a certain number of chemists, the curious facts attendant upon the etherification of silicic acid did not appear to have completely settled the question, I undertook the task of examining if it were not possible to obtain—either by substitution, or by the production of certain double chlorides analogous to double fluorides already known, or by the production of certain new compounds of ethal or amide—such results as would throw a light upon the general nature of this important subject.

The difficulties to be encountered in the preparation of the greater number of these compounds, the long and tedius manipulation which researches of this kind demand, in which the chloride of silicium is an indispensable agent, furnish circumstances which have limited my means of experimenting on this subject. But, incomplete as my experiments have been, they are, nevertheless, in some degree worthy the attention of chemists.

My labours will naturally divide themselves into three distinct portions, corresponding to the three orders of fact which I have observed. The present memoir will only comprehend the first portion of these researches.

COMPOUNDS DERIVED FROM THE CHLORIDE OF SILICIUM BY SUBSTITUTION.

When at the ordinary temperature chloride of silicium and hydrosulphuric acid are brought into contact, these two substances do not appear to manifest any mutual reagency. But if the two substances in a vaporous condition be transmitted through a red-hot porcelain tube a material reaction takes place, abundance of hydrochloric acid is disengaged along with the excess of chloride of silicium used, and a small quantity of hydrosulphuric acid, which escapes decomposition.

A good method of performing this experiment consists in putting the chloride of silicium to be acted upon into the bulb of a tubulated retort joined to the porcelain tube. Through the tubulature of this retort a tube is forced down to the level of the fluid, but not deeper. Through this tube the hydrosulphuric acid gas is passed.

At the *exit* extremity of the porcelain tube there is adapted a connector, which communicates with a U-shaped tube, which must be retained at a low temperature. There very soon begins to condense in the U tube and the connector a fuming liquid, possessed of a fœtid and pungent odour, reminding one of chloride of silicium and of hydrosulphuric acid. Ordinarily this liquid becomes milky, by the presence of a minute quantity of sulphur, which it holds in suspension.

If left some days in repose in a closed flask or tube, hermetically sealed, this liquor becomes clear, and deposits, besides some pulverulent sulphur, transparent and well-formed crystals of sulphur, but not of very large size, because the chloride of silicium, which is here the first indispensable matter, being costly and difficult to obtain in large quantities, the new substance, which represents but a small portion of the chloride, on account of losses, can only be obtained by small quantities at a time.*

The porcelain tube ordinarily contains a very small quantity of silica proceeding from the decomposition of a little of the chloride by the humidity of the corks of the apparatus. This silica is mixed towards the end of the tube with sulphur resulting from hydrosulphuric acid decomposed by heat.

In distilling with precaution the rough liquid thus obtained, putting aside that which passes of a density of 90° or 100° [of what scale?] (mixed with the new substance and with chloride of silicium), and stopping the operation towards its end, thick white vapours are disengaged in the distillatory apparatus, and there is, finally, obtained a liquid, limpid, colourless fluid, as water, boiling below 100° C., and capable of being distilled without residue. Its specific gravity is about 1.45, water being 1.

When brought into contact with water this substance is decomposed, whilst hydrosulphuric acid gas is disengaged, with the deposition of a small quantity of sulphur, hydrochloric and silicic acids, being simultaneously formed. With nitric acid of moderate concentration the deposit of sulphur is much less abundant, and there is no disengagement of hydrosulphuric acid if the reaction takes place in a closed flask, and agitation be continued for a short time.

Some preliminary experiments have convinced me that the substance did not contain hydrogen; I have, therefore, considered it as formed exclusively of chlorine, sulphur, and silicium.

Amount of Chlorine.—In order to ascertain the dose of chlorine a small quantity of the material was introduced into a little glass tube, the amount of the material being educed by comparing the weight of the tube before and after the introduction.

This tube was introduced with precaution into a flask *à l'emeri*, containing pure nitric acid diluted with about twice its volume of distilled water. After this the flask was closed. A few slight agitations were sufficient to break the tube; the flask was then cooled, and agitated during some seconds, in order to facilitate the reaction and the solution of the gas.

Ordinarily, far from there being any pressure from within, there was rarefaction. After having washed the stopper and the neck of the flask, and returned the water used in the operation into the latter, the chlorine was precipitated by means of a weighed solution of nitrate of silver of definite strength.

[*To be continued.*]

* These crystals of sulphur sometimes possess forms so well defined that oblique prisms can be easily discovered with rhombic bases, without any modification.

This crystallization of sulphur in the moist way, in the same system as by the dry way, appeared to me to be a phenomenon sufficiently rare to merit peculiar attention. The small amount of material on which I operated each time did not admit of my obtaining the crystals sufficiently large to measure the angles with any exactitude.

I once obtained in the same liquor crystals similar to the preceding, but in octohedrons. This peculiarity was at first embarrassing, but I afterwards perceived that the tube in which I had found these crystals had its point broken off.

This circumstance, apparently insignificant, merits, nevertheless, to be noticed, because I afterwards discovered that, if a small quantity of the liquid be exposed to the air in a tube not completely closed, there may be obtained, as a product of slow decomposition under the influence of the humidity of the air, octohedral crystals of sulphur. These, however, are never quite transpareut.

M. L. CHAPOTEAU ON COLLODION.

This new product, destined by its physical effects to render great services to the art of surgery, is in certain conditions much more valuable than has hitherto been imagined. If, after having dissolved the cotton prepared by sulphuric acid and nitrate of potash in ether, free from sulphurous acid, a portion of the liquid be allowed to evaporate, so that a gruel-like residue shall be formed, the tenacity of collodion is extraordinary. Of many examples I will cite one.

I took a strip of lamb's-skin about twenty centimetres long and ten centimetres wide, and, having soaked it in some collodion that was turbid and rather thick, I applied it to the palm of the right hand, and a moment after I could suspend from the strip of skin, without dislodging it from my hand, a weight of 12 kilogrammes, 500 grammes. In order to obtain this result I must say again that the collodion must be well prepared, and in a state of thick solution. Nothing is more easy than to obtain cotton-powder, and hence collodion; but many precautions must be taken, which it would be improper to pass over in silence, especially for persons not much accustomed to chemical manipulations. The cotton-powder destined to the fabrication of collodion ought not as a rule to be made in large quantities, and should be invariably prepared in vessels possessed of great capacity. If by imprudence 30 grammes of dry cotton, 540 grammes of sulphuric acid, and 360 grammes of nitrate of potash were to be put together into a somewhat small vessel, a portion of the materials would be projected, on account of the rapid development of the nitrous vapours, nay, the cotton under the circumstances mentioned would occasionally burst into flame.

A skilful practitioner has complained to me that in some cases he was prevented from employing collodion on account of its too rapid evaporation. This rapid evaporation is doubtless inconvenient if the material have to be spread over all the surface of a bandage, but it can be obviated by spreading it by instalments. The collodion having, according to my experiments, the faculty of dissolving in ether after having been once dried, the idea occurred to me of applying it by means of a brush upon cotton bandages, and then allow the latter to become dry. A detached portion of the bandage, being moistened with ether, immediately reassumed the tenacious quality of collodion applied in the liquid state. Hence it becomes an easy matter to prepare in hospital practice these collodion bandages, just as diachylon straps are used in ordinary cases, a little ether being sufficient to be employed at the patient's bedside. With regard to the remarkable quality attributed to collodion by M. Soubeiran, that of its impermeability, I will venture to remark that this has been overrated, as the following experiment will prove. I spread upon a square piece of board furnished with points a piece of cotton cloth of the dimensions of about twenty-three square centimetres, and I applied to the surface, by means of a brush, four successive layers of collodion, and allowed them to become dry. A kilogramme of water was then turned upon the dried cloth, prepared as described, and after remaining there for two hours not one drop of the water had passed through. This result was remarkably satisfactory; but in pursuing the investigation the reverse was found to obtain. The cloth, freed from the water, dried, and corrugated, formed numerous little fissures, through which the water passed with great facility.

Collodion applied upon the surface of silk perhaps may give more satisfactory results in this respect; this I have not tried. In my opinion an invention is only valuable in proportion as it ministers to useful ends. Now, it is not the habitual wearers of silk who are most exposed to rain, to snow; in a word, to general atmospheric rigours. Will ever the desideratum be accomplished of rendering by the use of collodion stuffs not only impermeable but solid? This I should desire, and I believe that the manufacturer who solves this problem will

render a great advantage to society.—*Répertoire de Pharmacie.*

M. M. MORIDE ON A METHOD OF DISCRIMINATING BETWEEN BLOOD STAINS AND THE STAINS PRODUCED BY FRUITS.

All the remarks hitherto made by authors relative to the method of distinguishing between the stains of blood and of fruits are limited to the discovery of the presence of vegetable acids. But this is not sufficient in many toxicological cases, as the following instance will prove :—

A man of the commune of Nort, near Nantes, had been assassinated in the middle of a field, about nine o'clock at night, when he, accompanied by his nephew, was about to quit the field. The crime being known, suspicion fell upon the nephew, who had on many occasions threatened to kill his uncle. The house of this nephew, F. Feriet, at length being examined, there were discovered a shirt and a pair of trousers, both marked with red spots, having all the appearance of blood. The magisterial authorities at Nantes instituted thereupon an attentive examination, in order to determine the nature of these stains, the examination being delegated to Dr. Cox and myself. Immediately on perceiving the stains on the shirt penetrating the tissue, and appearing on either side, and the colour of which stains was of a dark red, notwithstanding the shirt had been washed; and which, distributed here and there, appeared to have been produced by a very small and rapid jet,—immediately on observing large stained patches of a red colour on a pair of brown trousers, we could not help forming the idea that the stains in question had been occasioned by blood, and the verification of this supposition appeared to be a matter of much simplicity.

The stained portions of the shirt and of the trousers were then separately put aside to macerate, according to custom, in distilled water and in ammonia, following out the method proposed by M. Braconnot. In the liquid which contained the stains of the shirt there occurred no acid reaction, no red colorization, even after the lapse of twenty-four hours. As regards the digestion of the portions of the trousers, on account of the unfixed nature of their dye stuffs, the fluid of digestion, after a few minutes, assumed a deep violet colour and powerfully reddened litmus paper. The same appearances were equally produced by similarly treating unstained portions of the same trousers.

Hydrochloric and hypochlorous acids produced the same effect on the shirt stains as they produce with dry blood. There was also a similar agency with prussiate of potash, and with turmeric paper. But when we came to try upon those stains the action of a solution of boiling potash, all doubt entirely ceased; for the stains became darker in colour, even black. When heated, moreover, in a convenient tube, the stains produced no alkaline reaction.

From this time we were convinced that the stains had not been produced by blood; and a microscopic examination of some little granules existing in the agglutinated hairy covering of the stained portion of the trousers, after having been impregnated with a weak solution of liquor potassæ, corroborated that opinion, by demonstrating to us well-determined vegetable cellules. The shirt and the trousers had then both of them been stained by the juices of fruits, and one single reagent had enabled us to distinguish them from blood stains, with which they might have been easily confounded.

Notwithstanding our favourable report the facts against the accused were so strong that he was condemned to perpetual imprisonment. His own account was that the stains in question were due to the juice of apples with which he had been making cider.

Amongst the experiments which we on this occasion made was one which succeeded in perfection, and which we will here cite.

When even very small blood stains are distributed over tissues it is generally difficult to determine their animalized nature by burning them in a tube. In order the more easily to determine this point we place the doubtful stain in the middle of a tube drawn out at one end about eight centimetres long and seven centimetres in diameter, taking care previously to fill the tube with a mixture of soda and caustic lime. A very small test-tube full of distilled water, into which is plunged a curved tube, completes the apparatus. If the tube be made red hot in the flame of a spirit-lamp, the organic matter decomposes, with disengagement of ammoniacal gas, if there be any present, and which turns litmus paper previously reddened by acid fumes blue when dipped into the fluid.—*Journ. de Chim. Médicale.*

OBSERVATIONS ON FURFUROL.

By M. A. CAHOURS.

A paper on this subject was recently inserted in the former series of this journal from the pen of Professor Fownes. The author in this paper directs attention to one of the most remarkable derivatives of furfurol—that formed by the action of ammonia—called by Mr. Fownes *furfuramide*, indicating its analogy with hydrobenzamide. From the low boiling-point of furfurol MM. Laurent and Gerhardt were induced to believe that the equivalent of this oil should be reduced to one third of that assigned to it by Mr. Fownes, and they thus fix the formula :—C^{10} H^4 O^4.

The author undertakes the present inquiry with a view to ascertain the validity of this equation. The process followed was that of Mr. Fownes; but a small amount of sulphuric acid was employed, and thus more furfurol was obtained.

6 kilogrammes of commercial bran, 12 quarts of water, and 5 kilogrammes of sulphuric acid of 1.834, produced 101 grammes of erude furfurol and a liquid saturated with furfurol, which yielded by contact with ammonia 54 grammes of furfuramide, equal to 57 of furfurol; making in the whole 158 grammes, or 2.63 per cent., or nearly three times as much as Mr. Fownes obtained.

Now, the question is, which of the two substances contained in the bran is decomposed by sulphuric acid and yields furfurol?

The latter has no existence as such in the bran, as I have proved by distilling several quantities with pure water. Among the principles contained in the bran are lignine, starch, and gluten. On examining the action of sulphuric acid on these substances separately with sulphuric acid, in neither could I detect the presence of furfurol. I am thus compelled to ascribe the formation of this curious oil to some other principle present in the bran. Furfurol, when prepared according to the foregoing directions, boils at 324° F., and is in every respect analogous to the substance described by Mr. Fownes. An analysis of it gave the following results :—

Carbon	62.31	62.38	10 = 750	62.50
Hydrogen ..	4.29	4.23	4 50	4.17
Oxygen	33.40	33.39	4 400	33.33

It will be observed that these results correspond exactly with the results given by Mr. Fownes. To decide between the formula given by that gentleman and the one furnished by MM. Laurent and Gerhardt I took the density of the vapour of furfurol, which I found to be 3.342 to 3.346; theory requires 3.349, assuming the formula, C^{10} H^4 O^4, to be an equivalent of the substance. MM. Laurent and Gerhardt's hypothesis is thus confirmed. From its deportment with ammonia it seems to be isomeric with the oil of spiræa and the oil of bitter almonds, but in its reactions with other bodies it by no means presents results to be compared with those yielded by the above substances; thus, whilst chlorine and bromine furnish us with those compounds of which the type is oil of bitter almonds, derivatives which are either crystalline or volatile at fixed temperatures, and stand in a most simple relation to the elementary bodies, furfurol only yields black substances of a resinous character.

Nitric acid of both kinds has a violent action upon it, and yields oxalic acid as an ultimate product, not furnishing, like the bodies of the aldehyde group, either an acid derived from furfurol by the mere fixation of oxygen, or a substance only differing by the substitution of one or more equivalents of hyponitric vapour, or an equal number of equivalents of hydrogen. Chromic acid acts very violently upon furfurol, as does also a mixture of sulphuric acid and peroxide of manganese, and both bodies convert it into a brown substance. Of all reagents ammonia gives most decisive results. From the researches of Mr. Fownes it is now known that furfurol becomes solid in contact with ammonia, and yields a crystalline substance analogous to hydrobenzamide; this substance he has called furfuramide. The latter, when heated with a dilute solution of caustic potash, experiences a remarkable isomeric change, yielding the alkaloid furfurine, a substance very analogous to quinine and morphine. In examining these different compounds I have confirmed all the more important results of Mr. Fownes, and have likewise produced some new compounds, which I now proceed to describe.

The first compound I found by dissolving furfuramide in alcohol, and acting on it by sulphuretted hydrogen; the compound thus formed differing from furfurol in this, that half the oxygen was replaced by sulphur. When the alcoholic solution is weak, and the current of sulphuretted hydrogen very slow, a white crystalline powder is, after some time, separated; if the solution is concentrated and hot, and the current rapid, the substance separates with a resinous appearance. I have satisfactorily ascertained, by direct experiments, that no nitrogen was present in the compound. Analysis furnished :—

Carbon ..	53.78	53.63	53.29	10 = 750	53.58
Hydrogen	3.74	3.64	3.82	4 50	3.58
Sulphur ..	..	28.28	28.17	2 400	28.58
Oxygen ..	..	..	..	2 200	14.26

I propose to call this substance, on account of the analogy of composition it presents with furfurol, *thiofurfurol*. The same product is also formed by the action of hydrosulphate of ammonia upon a solution of furfurol.

A similar change is observable when an alcoholic solution of furfurine is submitted to the action of seleniuretted hydrogen. The clear liquid becomes turbid, and a resinous substance is thrown down, an analysis of which gave 38.05 carbon and 2.31 hydrogen. The substance is, therefore, analogous to thiofurfurol, if we suppose that the two equivalents of sulphur are replaced by two equivalents of selenium :—

Carbon	10 =	750.0	37.68
Hydrogen	4	50.0	2.51
Selenium	2	495.3	49.74
Oxygen	2	200.0	10.07

This substance I have named *selenio*-furfurol.

This furfurol melts when heated, and diffuses a strong unpleasant odour: if heated at a high temperature in the air, it burns with a slightly blue smoky flame, and a strong odour of sulphuric acid is perceptible; distillation entirely decomposes it, and beautiful crystals are produced, containing no sulphur.

This new crystalline substance forms very long colourless or faintly yellow needles, with an adamantine lustre. These crystals are hard, pulverulent, and friable. The substance is not soluble in cold and but sparingly soluble in hot water, from which it separates in minute acicular crystals. It is readily dissolved in alcohol, especially hot, and also in ether. The former solution, by exposure, becomes of a brown colour. The substance is strongly acted upon by nitric acid, and converted into oxalic acid. An analysis gave—

Carbon	72.72	72.90	72.87	72.99	72.89
Hydrogen ..	5.31	5.24	5.36	5.20	5.23
Oxygen	21.81	21.86	21.77	21.81	21.81

The simplest formula in which the composition

of this product can be expressed is C^{13} H^8 O^4, which implies the numbers—

Carbon	18 =	1350	72.97
Hydrogen....	8	100	5.40
Oxygen.....	4	400	21.73

Because, if we assume the equivalent to be one half less, we obtain for the carbon an odd number of equivalents—a chemical impossibility; but the foregoing formula represents only a submultiple of the true equivalent. This is a point I have been unable to decide, not having succeeded in obtaining any well-marked combination of the substance of its equivalent. The formula of thiofurfurol must at least be twice C^{10} H^4 O^2 S^2. The sulphuretted substances arising from the action of hydrosulphuric acid upon hydramides formed by aldehydes must thus have a multiple equivalent of that of the aldehydes, but as all these products are decomposed by heat it is not practicable to demonstrate the truth of this proposition. But it is certainly proved by the facts stated by Mr. Fownes, taken in connection with my own observations above stated, that furfurol should be referred to that class of bodies which comprehends oil of spiræa and oil of bitter almonds.—*Annales de Chemie et de Physique*, Nov., 1848.

ON LIQUID PROTOXIDE OF NITROGEN.

By M. DUMAS.

Herr Nattali, of Vienna, has succeeded in constructing a forcing-pump for the liquefaction of gases, and has thus enabled the chemist to obtain carbonic acid and protoxide of nitrogen in a liquid form. This instrument in my hands has been chiefly employed for liquefying protoxide of nitrogen; but experience soon suggested a number of cautionary regulations and managements, under which I have been enabled to effect this liquefication with despatch and safety, as well as on a large scale, at a small expense.

The liquid protoxide of nitrogen furnishes the means of producing a very low temperature; indeed, it may be interesting to point out the observations which its employment has enabled me to make. The first remark concerns the receiver or reservoir, which is the principal part of the instrument. I am of opinion that as it leaves the hands of the Viennese inventor it is not sufficiently strong. I have, therefore, had it enclosed in a belt of wrought iron, capable of resisting three hundred atmospheres, and very recently made by M. Bianchi. I have also made arrangements for surrounding the reservoir with a body of ice, so that the body of the pump is continually kept cool by a circulation of water round it, and the piston itself is constantly moistened with cold water; there is, therefore, no danger that the valve of the piston will be injured by the heat evolved by the compressed gas, and by its peculiar action as an inflammable gas. Under these conditions we may compress, in the course of two hours, two hundred litres of gas into the reservoir. Twenty litres suffice to produce a pressure of thirty atmospheres, and it is about this point that liquefaction commences. The rest of the gas supplies the liquid. One hundred litres of the gas produce, as nearly as possible, two hundred grammes of liquid. The gas ought to be quite dry to prevent failure, and must also be pure. I prepare it in the usual manner from nitrate of ammonia, and after drying it put it into macintosh bags; two pounds of ammonia are sufficient. The gas once liquefied will keep for one or two days in the reservoir; this, however, slightly injures the valve. When the stopcock of the reservoir is opened gas escapes; at first a portion freezes, but it soon flows liquid; the solid portion is like a mass of snow; it melts upon the hand, and evaporates very rapidly, leaving a severe burn. The liquid portion is by far the more abundant; from 20 to 30 grms. may be obtained in one operation. When this is received in a glass it will keep in the air for half an hour, or even more.

In order to be enabled the better to observe the properties of the liquid I collected it in open tubes placed in a vessel, the bottom of which was filled with pumicestone moistened with sulphuric acid. Under these circumstances it maintains its transparency for a long time.

Protoxide of nitrogen is liquid, colourless, very mobile, and transparent; every drop which falls on the skin leaves a very painful burn. Slow ebullition sets free a gas possessing all the properties of the protoxide of nitrogen. When metals are dropped into this liquid they produce a hissing noise, resembling that of red-hot iron plunged into water. Quicksilver produces a similar noise, freezes instantly, and yields a hard, brittle mass, resembling silver in colour and general appearance. Potassium floats on the surface of the liquid, and is not changed; the same is true of iodine, charcoal, sulphur, and phosphorus. Ignited charcoal will float upon the surface of the liquid, burning with considerable brilliancy, and sometimes until the whole is consumed. Common sulphuric acid and strong nitric acid freeze instantly. Ether and alcohol mix with the liquid, and do not freeze. Water instantly becomes ice; but the experiment is a dangerous one, since an evaporation of part of the liquid is produced so suddenly as to cause a kind of explosion.—[*From a Memoir read at the Academy of Sciences*, October, 1848.]

OBSERVATIONS ON NITROPICRIC ACID.

By H. BLUMENAU.

Most writers on chemistry state that this acid is not decomposed by nitric acid. That this is an error, and that under certain conditions nitropicric acid is decomposed apparently into nitric oxide, oxalic acid, and perhaps also carbonic acid, is the aim of this notice to point out. In order to prepare some nitropicric acid, three pounds of the best indigo were placed in thirty-five pounds of nitric acid just at the point of ebullition, and, as the violent action subsided, the whole was removed into a retort. A considerable quantity of the (so-called) resin had formed, but the liquid, on cooling, furnished abundance of crystals. In order to destroy the resin the contents of the retort were for seven days kept simmering ten hours a day. Red vapours were constantly evolved, and all but a mere trace of the resin had disappeared: but the inspissated liquids now furnished very few crystals of nitropicric acid; instead of weighing twelve ounces they weighed but six drachms. The whole operation was most strictly watched and carefully conducted. I am, therefore, compelled to attribute the loss of nitropicric acid to its decomposition of the nitric acid. In a later investigation, when heat was applied only for a very short time, the produce always amounted to one fourth of the indigo consumed, thus proving that a decomposition of the nitropicric acid must have had place in the former operation.

The form of the crystals of nitropicric acid is very variable. The crystals obtained from boiling water were of a lemon or canary colour, laminated and opaque; these by exposure to warm air became transparent and of a yellowish-brown colour. The crystallized acid obtained from alcohol had the same form, transparency, and colour. From ether the acid crystallizes on slow evaporation in beautiful yellowish-brown transparent trystals, having a faint glassy lustre, and in the form described by Mitscherlich. After long exposure to the air these crystals have the colour of thin laminæ which were obtained from hot water. By breathing on these yellow, cloudy crystals they are again rendered transparent; and if the decomposition has not penetrated too far into the interior they are by the same means rendered transparent. It would seem that the transparency is produced in the crystals that have separated from water by a loss of water; the same cause determining the opacity of those crystals which are obtained from ether.—*Liebig's Annalen.*

ON THE OXIDATION OF DRAGON'S BLOOD BY NITRIC ACID.

By H. BLUMENAU.

If the best dragon's blood (in sticks) is heated with from 5 to 8 parts of nitric acid of 1.33 to 1.35, a most energetic reaction takes place: red vapours are evolved, the mass foams profusely until it actually boils, and the agitation does not cease, nor the mixture become cool, until the dragon's blood is entirely decomposed, when the liquid becomes perfectly clear. If the nitric acid is employed greatly in excess, and the yellow liquid is evaporated nearly to dryness, dissolved in water, and put by to crystallize, oxalic acid is produced, which has a yellow tinge, perhaps owing to the presence of nitropicric acid. But if, on the other hand, nitric acid of 1.33 or 1.35, diluted with an equal weight of water, is employed, the result is totally different, — the dragon's blood is dissolved with a gentle heat, and accompanied by the evolution of red fumes. The liquid which passes over emits a smell, very much like nitrobenzide or like prussic acid, and presents some appearance of an oily film.

The liquid was repeatedly passed back into the retort, until nearly all the nitric acid was removed. It was then taken out, and the residue in the retort again mixed with nitric acid, and distilled until scarcely any red fumes were perceptible. The whole was then poured into a dish, evaporated almost to dryness, put by to cool, submitted to pressure between blotting-paper, and neutralized with carbonate of soda. The solution was decolorized with pure animal charcoal, and concentrated nitric acid was then added to it, until its reaction became acid: the precipitate was collected on a filter, pressed, and washed in ice-water. When dry it is a white mass of very small scales, consisting of two substances, one volatile the other not. The former of these sublimes and crystallizes from water in the same form as benzoic acid.

The mode of its formation, and its reactions, however, must sufficiently distinguish it from that substance, and it most probably is Mulder's nitrobenzoic acid. It is easily separable from the fixed acid by a gentle heat. I can only say of the fixed acid that it does not appear to crystallize readily, but usually comes away as a powder, which turns brown and carbonizes at a high temperature.—*Liebig's Annalen.*

FOREIGN SCIENTIFIC INTELLIGENCE.

PARIS ACADEMY OF SCIENCES.

ON THE ACTION OF FUMING NITRIC ACID AND A MIXTURE OF SULPHURIC ACID AND NITRIC ACID ON THE SALICYLATE OF METHYLENE AND ITS ISOMERIC ANISIC ACID. BY M. CAHOURS.

In a previous communication, relative to the action of a mixture of sulphuric acid and fuming nitric acid on organic substances, I pointed out that the salicylate of methylene exchanged, under the influence of this reagent, 2 equivalents of hydrogen against 2 equivalents of hyponitric vapour, thus giving rise to the binitric salicylate of methylene—

$$C^{16}\,H^6\,O^6$$
$$(Az\,O^4)^2$$

When treated with a concentrated and boiling solution of potash, this product doubles itself, in furnishing a salt of potash in the form of needle-shape crystals of a splendid crimson colour. If to a concentrated solution of this salt weak nitric acid be added, a yellow powder is set at liberty, which dissolves in boiling water, and is deposited, by cooling, in the form of a crystalline powder of a beautiful yellow colour. This product, the real nature of which I at first mistook, and which I considered as the free acid of the preceding salt, is a salt of potash, which does not give up its base except to powerful and concentrated acids, such as the sulphuric, comports itself in the same manner as the bichloride and bibromide salicylic acids, which also form salts

of great stability, of little solubility, and which are not decomposed except by strong acids.

Several analyses agreeing exactly with each other of this substance, and of some of its salts, show that its composition would be expressed by the formula—

$$\begin{matrix} C^{14}\ H^{4}\ O^{6} \\ (Az\ O^{4})^{2} \end{matrix}$$

This product, which does not differ from salicylic acid, $C^{14}\ H^{6}\ O^{6}$, except that 2 equivalents of hydrogen are replaced by 2 equivalents of hyponitric vapour, is then the binitric salicylic acid.

This acid, but little soluble in cold water, dissolves well in boiling water, and separates on cooling in the form of long white needles with a slightly yellow tinge, analogous to cafeine; by spontaneous evaporation it sometimes crystallizes in the form of shortened prisms grouped around a common centre.

Alcohol and ether dissolve it readily, and on evaporation crystals are produced.

If a current of hydrochloric gas be passed into an alcoholic solution of this acid, kept at a temperature of from 70° to 80° C., it promptly etherifies; water added to the alcoholic solution, reduced to one half of its volume, causes the precipitation of a yellowish heavy oil, which soon concretes. This product, purified by one or two crystallizations in alcohol or ether, takes the form of very brilliant white scales of a slightly yellow tint, and very much resembling the binitric salicylate of methylene.

Several analyses of this substance have led to the adoption of the formula—

$$\begin{matrix} C^{18}\ H^{8}\ O^{6} = C^{14}\ H^{5}\ O^{5}, & C^{4}\ H^{5}\ O. \\ (Az\ O^{4})^{2} & (Az\ O^{4})^{2} \end{matrix}$$

It may also be obtained by acting on salicylic ether with a mixture of sulphuric acid and fuming nitric acid.

The anisic acid isomeric with the salicylate of methylene gives very different products when acted upon either by fuming nitric acid, or a mixture of nitric acid and Nordhausen sulphuric acid.

Treated by fuming nitric acid alone at a slight heat for some minutes, the anisic acid loses one equivalent of hydrogen and gains $Az\ O^{4}$, giving rise to nitranisic acid, isomeric with the indigitate of methylene. If, instead of thus operating, anisic acid be boiled for half an hour with eight to ten times its weight of fuming nitric acid, a completely neutral product is obtained, insoluble in water, crystallized in long needles, which present the composition and properties of binitric anisol.

$$\begin{matrix} C^{14}\ H^{6}\ O^{2} \\ (Az\ O^{4})^{2} \end{matrix}$$

Treated by a mixture of sulphuric acid and fuming nitric acid at the boiling temperature, the anisic acid yields a product completely neutral like the preceding, which I had erroneously considered as trinitric anisic acid. This substance, which crystallizes in beautiful rhomboidal tables of large size, is trinitric anisol—

$$\begin{matrix} C^{14}\ H^{5}\ O^{2} \\ (Az\ O^{4})^{3} \end{matrix}$$

Such is the constitution of these two compounds, for they may be obtained possessed of entirely identical properties by the action of the preceding reactions on anisol.

I am also certain that, at the same time that these products are produced, a considerable quantity of carbonic acid is disengaged. These reactions may be explained by means of the following equations:—

$$C^{16}\ H^{8}\ O^{6} + 2Az\ O^{5}, HO = 2CO^{2} + 4HO + \begin{matrix} C^{4}\ H^{6}\ O^{2}, \\ (Az\ O^{4})^{2} \end{matrix}$$

$$C^{16}\ H^{6}\ O^{6} + 3Az\ O^{5}, HO = 2CO^{2} + 6HO + \begin{matrix} C^{14}\ H^{5}\ O^{2} \\ (Az\ O^{4})^{2} \end{matrix}$$

Binitric anisol and trinitric anisol, when heated with a concentrated solution of potash, double themselves, giving rise, the first to nitrophenesate, the second to nitrophenisate, of potash. We have thus:—

$$\begin{matrix} C^{14}\ H^{6}\ O^{2} + KO, HO = C^{12}\ H^{2}\ O, & KO + C^{2}\ H^{5}\ O, HO \\ (Az\ O^{4})^{2} & (Az\ O^{4})^{2} \end{matrix}$$

$$\begin{matrix} C^{14}\ H^{5}\ O^{2} + KO, HO = C^{12}\ H^{2}\ O, & KO + C^{2}\ H^{3}\ O, HO. \\ (Az\ O^{4})^{2} & (Az\ O^{4})^{2} \end{matrix}$$

Anisol would be, therefore, a veritable ether, the phenate of methylene; and binitric and trinitric anisol would be, the first the nitrophenesate, and the second the nitrophenisate, of methylene.

The salicylate of methylene is represented by the formula—

$$C^{14}\ H^{5}\ O^{5}, C^{2}\ H^{5}\ O.$$

Under the influence of the anhydrous alkalis salicylic acid loses two molecules of carbonic acid, and is transformed into phenyle, which in the nascent state remains united to the oxide of methyle to constitute the phenate of methylene or anisol.

In the same way salicylic ether heated by the anhydrous alkalis loses two molecules of carbonic acid, and changes into a neutral product, phenetol, homologous with anisol—

$$C^{15}\ H^{10}\ O^{2} = C^{12}\ H^{5}\ O, C^{4}\ H^{5}\ O,$$

which I consider as phenic ether.

Chloroform, Ether, etc., Used Externally as Anæsthetic Agents. — M. Jules Roux, surgeon-in-chief to the French Navy, has successfully employed aldehyde, ether, and more especially chloroform, in preventing the pains consequent on an operation, or which arise during cicatrization; this he effects by the direct application of the liquid to the wounded parts, for five, ten, or fifteen minutes, by means of a camel-hair brush or sponge; the preferable mode being to sprinkle the fluids on the wounded parts, or to fill their cavities with the anæsthetic agent.

Prussian Sanitary Regulation.—The Prussian municipal law (Allgemeine Landrecht) contains the following enactments with regard to the sale of spoiled or adulterated victuals. Th. II. Tit. 20.; Abschnitt 11.; §§ 722 to 725:—"No person shall knowingly sell, or communicate to other persons for their use, articles of food or drink which possess properties prejudicial to health, under a penalty of fine or bodily punishment. Whosoever adulterates any such victuals in any manner prejudicial to health, or mixes them with unwholesome materials, especially by adding any preparation of lead to liquors, shall, according to the circumstance of the case, and the degree of danger to health, be liable to imprisonment in a correction-house, or in a fortress, during a period varying from one to three years. Besides this punishment, those who are found guilty of knowingly selling victuals which are damaged or spoiled (verdorbener), or mixed with deleterious additions, shall be rendered incapable for ever of carrying on the same branch of business. The articles in question shall be destroyed if incorrigibly bad, but if otherwise they are to be improved as far as possible at the cost of the culprit, and then confiscated for the benefit of the poor. Further, whosoever mixes victuals or other goods with foreign materials, for the purpose of increasing their weight or bulk, or their seeming good qualities, in a deceitful manner, shall be punished as a swindler." It is singular how, amid the law-making mania which has actuated our senators for many sessions, that not even one bill has been framed for the protection of the people from spoiled and adulterated foods and drinks.—*Ure.*

Longest Electric Telegraph.—The longest electric telegraph yet erected is that between Montreal and New York. It is one thousand and twenty-one miles in length, and the electricity travels direct from city to city.

THE CHEMICAL TIMES.

SATURDAY, DECEMBER 9, 1848.

OUR OWN SERIES.

No. II.

ON CHEMICAL MANIPULATION.

The Cleaning of Glass—(*Continued*).

Having given much primary instruction for well accomplishing the most indispensable operation of glass-cleaning, we will now proceed to another lesson in our code of instruction: not, however, without most emphatically assuring the learner that if he do not, in the very beginning—at once, and for ever—create for himself such a delicate eye for perfect lustre in his glass instruments, that the slightest appearance of stain or spot,—to say nothing of those vulgarly palpable accumulations of foreign matter ordinarily known as dirt,—shall affect him with feelings of loathing and disgust, he is not of those materials out of which a chemist can be made. Let him turn his attention to other things. But many have not the advantage of ocular chemical instruction—probably the greater number of our readers are thus situated—they have never seen what clean glass really is. How then, are they to be assured that they have succeeded in coming up to the mark of absolute perfection which we proclaim to be so necessary to the prosecution of chemical research? Why, a very good plan is the following, and it is the more valuable for being within the means of every body. The plan consists in training the eye to consider the domestic glassware of the most scrupulously cleanly family as *dirty*, unpleasing to look at! This is a most startling suggestion, doubtless, but a perfectly sound and true one. If the cleaning of glass were a thing to be achieved by any one,—and if the ordinary notions of cleaning which suffice for domestic purposes were sufficient,—the young chemist need not be made to ponder over this long and monotonous tale. But it is otherwise.

With the view, therefore, of testing the correctness of his eye for cleaning glass, let the young pupil do this:—Let him select out of all his acquaintances some lady most celebrated for the elegance of her ménage—let him well regard her wine glasses, her tumblers, her vases—let him look at these glass articles from different points of view—let him view them by transmitted light, by reflected light; in short, in many positions with reference to the situation of his eye. If, then, such being done, he can entertain the sentiment,—even for a moment, of their cleanliness, he is in an unfit train of mind—he cannot yet hope to be a chemist; for the prosecution of that science he has another sentiment to create. If, however, our remarks have so affected him that he sees with a new-born light as it were, the various diminutions of lustre, the various spots, the various flaxen filaments and bits of dust which *always* exist on the surface of the most scrupulously-cleaned domestic glass, then the learner is in a proper train of mind to profit by our future instruction, and may proceed.

Proceed with what? no *more* glass! we hear the pupil say. Ay, glass again!

We have hitherto treated of the simplest case—of the method to be pursued in the cleaning of such glass instruments as can easily be reached by the hand or fingers. Now, it will occur to the merest tyro in chemistry that a great number of glass instruments used by chemists are not of this kind. A great number consist of flasks, possessing mouths of varying size,—of tubes, of retorts, and a multitude of irregular forms, which the progress of chemical experiments constantly resquires, but for which there is no name. That all these should be thoroughly, absolutely, cleansed is quite as necessary as that the wide-mouthed vessels, of which we have already treated, should be so. And now, once for all, let us come to the understanding with our readers that *clean* and *cleanliness* are in themselves definite terms, and want no expletives, with people who regard language as a means of disseminating, not of obscuring, ideas. Henceforth we shall employ the terms, then, without expletives. Tell a chemist that such and such a glass is moderately clean, he would stare; as well might he be told that his wife is moderately virtuous. The term, we repeat, admits of no compromise whatever. But to resume. Straight glass tubes are not only amongst the simplest forms of small-orificed glass apparatus, but are the most constantly employed. No matter what the chemical operation may be, still there will be required, in some stage of it at least, glass tubes of some form or other. Generally these forms will be given by the operator himself; and, if he commence on a clean piece of straight tube, the resulting bent, or bulbed, or otherwise complex one will turn out clean to his hand, thus saving him much future trouble; indeed, it may be laid down as a general rule, that, if glass in a dirty condition be bent or blown into any new form of apparatus, the dirt will be so burned in, or will otherwise so affect the glass, that the apparatus becomes valueless; not merely because a considerable amount of opacity is the result, but because it will have acquired a fragility most inimical to the changes of temperature attendant on the majority of chemical operations. Glass tubing is now exceedingly cheap, and the various purposes to which it is applied almost preclude any definite directions on our part as to the best kinds for a young chemist to have; that is to say, in regard to exact diameter. As our present directions, however, are not intended to refer to any specific course of chemical experiments, but are to aid the general practice of young chemical aspirants, we would advise him to obtain a pound of soft English flint glass tubes, varying in size from the external diameter of a goose quill or smaller to those of half an inch.

In choosing them it should be seen that each piece is straight, and that both inside and out the diameter may not vary for each piece. Occasionally tubes run taper, and these, although preferable for some few purposes, should not find their way into the general laboratory stock. The learner should also have tubes of various thicknesses. On this point we can give no specific instructions; but in following us through our course he will soon find which kind of tube is best adapted to his various wants. In the laboratory each length of tube should be tied over with a little piece of tissue paper to keep out the dust, and put away in a convenient drawer. The best kind of drawer for this purpose is one that slides lengthways into a deep recess, and the pull-out end of which consists of a drop-down flap. By this contrivance the chemist can immediately observe by the end what particular length of tube is best adapted to any required purpose, and can easily pull it out although at the very bottom of the drawer. Practice alone can demonstrate the great convenience of being able to accomplish this easy selection.

When the tubes first come from the glasshouse they scarcely contain any impurity but particles of dust, which may easily be wiped away by passing through them a soft bit of silk or a small piece of chamois leather attached to a string or wire. As to the exterior part of tubes, whatever the nature of any impurity there visible, the tubular form is most convenient for perfect cleansing; and, beyond the general principles of cleansing already detailed, we have nothing more to say on this point.

With regard, however, to manufactured pieces of tube, when dirty, we will now proceed to make a few remarks; dividing them, for the sake of distinction, into those which are closed at one end, and those which are open. The latter, as presenting the simpler case of the two, shall first receive our consideration. After test-glasses in importance (some people will reverse the sequence) come test-tubes; small vessels of glass, varying from three to six or more inches in length, aud from one sixth to one inch in diameter. Those instruments are employed as representatives of test-glasses, and over which they possess the advantage of readily standing the heat of a spirit-lamp, or other heating source. They enable the operator to enlarge the sphere of his chemical inquiries by the application of heat without the necessity of transferring the liquid operated upon to a second vessel.

It is not our object, however, at present to point out the advantages and disadvantages of test-glasses and test-tubes one over the other. All we have now to state is, that test-tubes are used, must continue to be used, by every chemist, whatever his sphere of operations—and, perhaps, more by the amateur chemist than any other; that they get dirty by being so used, and that *they must be cleaned*. A slight consideration will not fail to show that their cleaning is a matter of some little difficulty beyond that of cleaning a test-glass. Not only is a test-tube smaller and longer,—so small and long that the finger is unable to apply direct friction,—but, being in general composed of thiu glass, at least at the sealed end, they must be manipulated with great delicacy, or they break. When it is intended to clean a batch of test-tubes, the nature of the prevailing impurity with which they are soiled should be well determined. They should then be put to soak in such a menstruum as is known to be most efficacious as a cleansing agent. From time to time the chemical action of the menstruum should be aided by the mechanical friction of a little pledget of linen or cotton tied to the end of a slender bit of wood, or to the end of a copper wire, taking care that the end of the wood, and more especially of the wire, should be so well guarded or enveloped by the rag that neither of the ends shall come into contact with the thin sealed part or bottom of the tube; which would, under the circumstances, be most infallibly broken. Whenever the end of a wire, and more especially of iron, is brought into contact during friction with the inside of a glass tube, a most curious effect often results, which cannot be too forcibly impressed on the young chemist's attention. The glass so treated becomes very liable to fracture, and, indeed, very often breaks spontaneously. This is due to a certain vibrative disturbance of the molecular constitution of glass which diminishes the force of cohesion. Iron wire is much more mischievous in this respect than copper wire, being harder: therefore, it should never be used for any purpose involving its contact during friction with glass.

Having, by the united agencies of the chemical menstruum and the mechanical friction, dislodged such impurities as might have been attached to the inside of each tube, the tubes should now be well rinsed out in several consecutive waters (the last being by preference distilled or rain water); and placed mouth downwards before a fire or stove to drain. Being drained, they are to be wiped dry by pieces of rag tied to the end of a stick, or the water may be absorbed by pledgets of filtering paper. The tubes may now be polished by little pieces of chamois leather, and they are fit for use. If cleaned and not used directly, but put away, they will be certain, after the space of a few hours, to have become speckled with dust; hence they must not be employed without the preliminary of wiping out.

The cleaning of more complex forms of close glass apparatus will constitute the subject of the next article in our series.

WHOLESALE SUFFOCATION ON BOARD AN IRISH STEAMER.

Never has it been our lot to contemplate so lamentable a result of imperfect acquaintance with hygienic principles as that horrible instance of wholesale suffocation ou shipboard which most of our readers will have seen recorded in the daily journals of this week.

Since the revolting event at Calcutta, an event now of historic fame, the world has not seen an instance of wholesale smothering at all comparable with the one before us. It would be evidently improper, in the present undigested state of the evidence which has come to hand relative to this melancholy subject, for us to offer any comments which might seem to inculpate those who are held responsible for the act before the law; but we consider it a fitting occasion to animadvert on the general inadequacy of accommodation for deck passengers in most of the Irish steamers. The overcrowding of the Thames river steamers is an impropriety which, having come under the immediate notice of our City authorities, has often been a subject of comment in our journals. The subject, although amply worthy of animadversion in itself, is of much less painful interest than that presented by the crowded decks of an Irish steamer. On account of the peculiar relations between the population

of the two islands, an amazingly large number of the poorest order are continually tossed about as deck passengers on the boisterous Irish Sea. The largest crowds of these unfortunates are to be seen on board the vessels plying from the ports of Liverpool and Bristol; and, even during the comparatively short passage between these starting points and the Irish coast, few can be aware of the extent of suffering to which the poor deck passengers are exposed. Between London and Cork (an average passage of four days) these privations and sufferings are greatly increased even in the finest weather: exposure for many nights in succession to the night air, the dews, the showers of our variable climate, are sufficient to affect the strongest in constitution, and to undermine the weak; add to this starvation and rags,—the lot of these poor people, and their cup of misery is well-nigh full. But what pen shall describe the exaggerated misery, the accumulated despair, of those miserable creatures during the prevalence of a storm?

The slightest approach to hard weather is sufficient to deluge the decks with water. Old men and women benumbed with cold—half-starved mothers with children at the breast—the crippled, the diseased, the weak—all deluged with the brine! That state of weather denominated by nautical people as "half a gale" necessitates the retirement of the prostrate, half-drowned crowd below. But where? In the fore cabin, where there is one (the Cork and London steamers have none), or the hold. Here, in impure atmosphere, all egress denied, whilst ingress of air is but partially allowed, the sufferers wait the result. Surely this state of things should be remedied. If steamers be permitted to take on board such crowds of human beings, provision should be made for their safety, if not for their comfort; and a practical provision could be provided without difficulty, in the shape of a permanently-fixed ventilator, or short chimney of iron, proceeding from the hold or fore cabin, and projecting a little way above deck. Then a free ingress of fresh air would be effected without the fear of an influx of water, and thus such horrors as the suffocation of a whole crowd by the battening down of hatches would be avoided.

MORTALITY IN THE METROPOLIS.

The Registrar-General's return of the births and deaths in London during the week ending on Saturday, December 2, gives the number of deaths as 1,167, being 13 above the weekly average of the five autumns ending in 1847; of these 372 are from zymotic diseases, being 2 above the average; dropsy, cancer, and other diseases of uncertain or variable seat, 50, being 2 below the average; tubercular diseases 175, being 9 below the average; diseases of the brain, spinal marrow, nerves, and senses, 126, being 1 below the average; diseases of the heart and bloodvessels 38, being the exact average; diseases of the lungs and other organs of respiration 193, being 29 below the average; diseases of the stomach, liver, and other organs of digestion, 9, being 43 below the average; diseases of the kidneys 12, being the exact average; childbirth, diseases of the uterus, &c., 1, being 4 below the average; rheumatism, diseases of the bones, joints, &c., 10, being 2 above the average; diseases of the skin, cellular tissue, &c., 1, being 1 below the average; malformations 5, being 2 above the average; premature birth 13, being 10 below the average; atrophy 27, being 8 above the average; old age 38, being the exact average; sudden deaths 15, being 3 above the average; violence, privation, cold, and intemperance, 35, being 3 above the average. In detail the return shows the following results: — Smallpox 21, being 2 above the average; measles 16, being 28 below the average; scarlatina 127, being 80 above the average; whooping cough, 47, being 13 above the average; croup 6, being 2 below the average; thrush 2, being 3 below the average; diarrhœa 24, being 3 above the average; dysentery 3, being 2 below the average; cholera 20, being 19 above the average; influenza 3, being 17 below the average; purpura and scurvy 1, being the exact average; ague 2, being 1 above the average; remittent fever 4, being 3 above the average; infantile fever 1, being the exact average; typhus 67, being 17 above the average; metria or puerperal fever 14, average not known; rheumatic fever 1, average not known; erysipelas 11, being 2 above the average; syphilis 2, being the exact average; noma or canker none, the average being 3; hydrophobia none, no average; hemorrhage 2, being 2 below the average; dropsy 19, being 6 below the average; abscess 3, being 1 below the average; ulcer 1, being the exact average; fistula none, no average; mortification 2, being 2 below the average; cancer 21, being 6 above the average; gout 2, being 1 over the average; serofula 10, being 5 above the average; tabes mesenterica 12, being 1 above the average; phthisis or consumption 123, being 11 below the average; hydrocephalus 30, being 2 below the average; cephalitis 13; being 1 below the average; apoplexy 24, being the exact average; paralysis 26, being 6 above the average; delirium tremens 4, being 1 above the average; chorea none, the average being 1; epilepsy 4, being 1 above the average; tetanus none, the average being 4; insanity 2, being the exact average; convulsions 40, being 9 below the average; disease of the brain 13, being 2 above the average; pericarditis 3, being 1 above the average; aneurism 2, being 1 above the average; disease of the heart 33, being 2 below the average; laryngitis 3, being the exact average; bronchitis 80, being 16 above the average; pleurisy 6, being 3 above the average; asthma 14, being 12 below the average; diseases of the lungs, &c., 5, being 10 below the average; teething 7, being 6 below the average; quinsey 1, being 1 below the average; gastritis 2, being 12 below the average; enteritis 7, being 7 below the average; peritonitis 3, being 1 below the average; ascites 1, being 1 below the average; ulceration of the intestines, &c., 2 being the exact average; hernia 2, being 1 below the average; ileus 2, being 1 below the average; intersusception none, 1 being the average; stricture of the intestinal canal none, the average being 1; disease of the stomach, &c., 6, being the exact average; disease of the pancreas none, 1 being the average; hepatitis 4, being 1 above the average; jaundice 1, being 1 below the average; disease of the liver 14, being 3 above the average; disease of the spleen none, 2 being the average; nephritis none, 1 being the average; nephria 1, no average; ischuria none, 2 being the average; diabetes none, 1 being the average; stone none, 1 being the average; cystitis 1, being 3 below the average; stricture of the urethra none, 1 being the average; disease of the kidneys 10, being 3 above the average; paramenia none, 4 being the average; ovarian dropsy 1, being the exact average; childbirth (see metria); diseases of the uterus 2, being 1 above the average; arthritis 2, being the exact average; rheumatism 6, being 2 above the average; carbuncle none, the average being 2; phlegmon none, the average being 3; diseases of the skin, &c., 1, being the exact average; intemperance 1, being the exact average; want of breastmilk 4, being 3 above the average; neglect and cold none; poison, burns, scalds, hanging, drowning, fractures, contusions, wounds, and other violence, 30, being the exact average; causes not specified, 5.

The total of the deaths occasioned by cholera since the 23d of September last is as follows:— In the west, 21; north, 16; central, 16; east, 71; south, 244; being in the whole 368. In the last two weeks the greater number of deaths from cholera has been in the east district.

Fatal cases of cholera registered in the week ending Saturday, December 2. Four are cases in which inquests were held; the remainder are all certified by medical attendants:—

Hackney; Hackney, South.—At London-lane, in South Hackney, in a private lunatic asylum, spinster, 40, "malignant cholera (2 days)." Hackney, West.—Girl, 3, "cholera (16 hours)."

St. Luke, City-road. — At Richard's-place, Old-street, son of a labourer, 2, "cholera (3 days)." In same house, wife of a labourer, 34, "cholera (12 hours)." [The medical attendant of the above cases states, "that the mother had been delivered of a child (about three weeks before) which died of cholera after two or three days' illness. She was in close attendance on her child night and day, and the disease, with extreme collapse, was the result. The house is confined, without any yard or outlet, and one or two persons have been removed from the next house into the workhouse."]

West London (North).—In St. Bartholomew's Hospital, M. 4, "cholera."

Shoreditch (Hoxton New-town).—In St. Luke's Workhouse, M. 22, "cholera (20 hours)." In the same workhouse, F. 40, "spasmodic cholera (27 hours)."

Shoreditch; Haggerstone, East. — F. 31, "Asiatic cholera (6 days), puerperal fever (3 days)" F. 2, child of the former, "cholera (10½ hours)."

Mr. Burchell, the medical attendant, states that "the woman was seized with Asiatic cholera on the evening of the 21st of November, from which, on the 23d, she was slightly recovering, inasmuch as the cramp, &c., had subsided in a great measure, and warmth in the extremities was gradually becoming restored. She was taken in labour during the day, and was delivered of a dead child at three o'clock a.m. on the 24th; after which she sank into a state of puerperal fever of a typhoid character, and died at half-past six o'clock a.m. on the 27th, after an ilness altogether of six days' duration."

Mr. Ditchman, the registrar, adds, "that he visited the spot and found the house so situated that about ten or twelve feet was the only space between the backs of the houses in Ann's-place and Goldsmith's-row. A privy, serving two houses, stands on the edge of an open sewer three or four feet wide (out of the above space of ten or twelve feet), which sewer extends from Talavera-place, Margaret-street, to Chapman's-gardens, a distance of 300 or 400 yards, in part covered with old boards, but for the most part open and the receptacle of all kinds of refuse. The parochial authorities have no control whatever, as it belongs to the commissioners of sewers, to whom repeated letters of complaint have been written by the clerk of the Four-rate Board, who has received no reply."

Whitechapel, the Artillery.—M. 5, "epidemic cholera (6 days); consecutive fever, and congestion of the brain (5 days)." F. 13, "epidemic cholera (4 days)." In addition to the above two cases, another death (not yet registered) took place on the 25th in the same house. A verdict was returned "Sudden death from Asiatic cholera (5 hours)." It was the case of a boy, 2 years and 8 months old. Mr. Mason, the registrar, adds, that "the neighbourhood is crowded and dirty, but the court is not more confined than many streets in Spitalfields." Whitechapel, North.—M. 50, in Boar's Head-yard, Petticoat-lane, "cholera Asiatica (30 hours)." Mr. Chapman, the registrar, states that "the houses are occupied principally by the lower order of Irish; that they are not well drained, but water is good and plentiful." Goodman's-fields.—At 21, White Bear-court, Lambeth-street, F. 58, "Asiatic cholera (18 hours).

St. George-in-the-East; St. John.—At 7, Anchor and Hope-alley, wife of a mariner, 50, "natural death—Asiatic cholera (20 hours)"—inquest. In the same house, wife of a mariner, 29, "natural death—Asiatic cholera (20 hours)"—inquest.

Stepney; Mile-end Old-town, Lower.—F. 29, "English cholera, typhus, brain fever."

Poplar; Sub-district Poplar.—M. 6, "natural death, sudden, from cholera (17 hours),"—inquest.

Bermondsey; St. James.—M. 36, "Asiatic cholera (11 hours)."

Lambeth; Brixton.—F. 40, prisoner in the House of Correction, "natural death, Asiatic cholera (38 hours),"—inquest.

Greenwich; Greenwich, West.—In Dreadnought Hospital, M. 54, "cholera (p.m)."

THE CHOLERA.

Registration Districts.	Total Cases of Cholera in each District from Sept. 28 to Dec. 4, 1848, both inclusive.				Fresh Cases of Cholera reported on Dec. 5, 1848.			
	Attacks.	Deaths.	Recoveries.	Result not stated.	Attacks.	Deaths.	Recoveries.	Result not stated.
Kensington, including Chelsea	25	15	1	9	2	1		
St. George, Hanover-square ..	1	..	..	1				
Westminster ..	16	5	10	1				
Marylebone.....	3	3						
Islington	1	1						
Hackney	8	7	..	1				
St. Giles	2	..	..	2				
St. Luke	2	..	..	2				
East Lond. West Lond.....	5	3	2					
Shoreditch	2	2	..	..	1	1		
Bethnal-green..	8	7	..	1				
Whitechapel ..	18	8	..	10				
St. George-in-the-East.....	5	4	..	1				
Stepney	17	8	3	6				
Poplar	9	4	..	5	3	1		
St. Saviour's, St. Olave	12	7	2	3				
Bermondsey ..	53	30	17	6				
St. George, Southwark....	31	21	3	7				
Newington	9	8	..	1				
Lambeth	52	30	5	20				
Camberwell....	66	28	33	5	1	1		
Rotherhithe ..	6	6						
Greenwich and Woolwich	66	24	16	26				
Wandsworth ..	11	4	1	6				
The Pool, River Thames.....	8	6	2					
	438	231	95	112	7	4		
The Provinces .	158	86	10	62	1			
Scotland	1064	465	196	403	25	11		
Totals	1660	782	301	577	33	15		

BIRMINGHAM PHARMACEUTICAL INSTITUTION.

THE COMMITTEE'S ADDRESS.

The committee have now placed before you a summary of the proceedings of the past year, and in conclusion they wish to offer a few observations on the objects of the Pharmaceutical Institution, and its claims to support.

This institution is a voluntary association of chemists and druggists, with a view to benefit their common interests, and more especially to increase the facilities for acquiring knowledge; and when the position of the pharmaceutist, and the qualification he requires in consequence of the heavy responsibility which devolves upon him, are considered, every one must perceive how much such an institution is needed.

Chemists and druggists have always, as a body, been regarded as occupying a position in society next in order to the learned professions, and, indeed, such an acquaintance with science and the usual subjects of a professional education is necessary for the competent discharge of their duties as would fully entitle them to that rank. All our members must be aware, however, that the position we have to preserve is not a stationary one—we see, from the rapid advance of all classes in intelligence, that to maintain our rank we must be continually progressing—the professional knowledge of our predecessors has become the common knowledge of our contemporaries; and it will be the duty of the coming generation of pharmaceutists to apply the multitudinous discoveries which science has already made and is still making to the further improvement of their art. Such are the increasing demands upon our skill; and are we to neglect and despise the obvious means by which they may be satisfied? Would it not be more pleasing, as well as more profitable, to do that which is required of us? The business we make choice of we are morally under an engagement to conduct with our best ability, and we may feel assured that we shall not be allowed to neglect this obligation with impunity.

It will, perhaps, be permitted us to remind you of some of the principal advantages of societies. In the first place, the property, and to a certain extent the intelligence, of the whole are at the service of every member. It will afford an illustration of the manner in which each may derive benefit if we suppose the case of some person in search of information upon any particular subject. How is he to obtain it? If he has no one to direct him in the inquiry, he may search through volume after volume, and spend weeks, or even months, in fruitless labour; whereas, by simply propounding the question to a society, the information might be obtained immediately. Every one who has been accustomed to study by himself must, at times, have felt the want of assistance, which would have saved much valuable time, and have conducted him with ease through difficulties that have nearly determined him to throw up his task in despair. Another use of societies is the stimulus given to thought by the associating and conversing together of a number of persons. It has been observed by those who have studied the operations of the mind, that by expressing our thoughts we give them permanence and fix them in the memory, and when several persons are brought to think upon the same subject there is less liability to error, for, if a few are led away by any prejudice, others who are not so biassed will be able to correct them.

These arguments will be sufficient to adduce for the present, and your committee will only add, that they believe this institution well calculated to answer your requirements, and that it will afford them the greatest pleasure to see it arrive at such perfection as to be both valuable to chemists and druggists, and an honour to the town in which it is situated.

BLOWPIPE REAGENTS.

The three principal reagents, indispensable in examination with the blowpipe, are:—

Carbonate of soda;

Biborate of soda, or borax;

Phosphate of soda and ammonia, or microcosmic salt.

These tests are to be provided in a state of purity; I shall, therefore, describe each separately.

1. *Carbonate of Soda.*—When a current of carbonic acid gas is passed through a saturated solution of the apothecaries' soda in water, bicarbonate of soda is precipitated in crystalline grains, which must be well washed with cold water, and dried. In this state it may be employed for qualitative analyses; but, when required in quantitative analyses, it must be calcined in a flat porcelain matras, to liberate the second atom of carbonic acid, and its water of crystallization.

Winkler obtains the bicarbonate of soda free from sulphate of soda in the following manner:—He dissolves 4 ounces of crystallized carbonate of soda in 8 ounces of distilled water, and adds to the solution $1\frac{1}{2}$ ounce of carbonate of ammonia; then heats the mixture to 133° Fahrenheit, in a water-bath. After some time a large quantity of bicarbonate of soda precipitates, which is separated from the supernatant liquor by filtration.

To ascertain whether the carbonate of soda contains any sulphate, mix two parts with one of pure silica, and fuse this mass upon charcoal, in the reduction flame; if the smallest quantity of sulphate of soda is present the resulting bead will be of a deep yellow or red colour, owing to the formation of sulphuret of sodium.

A second method for ascertaining the presence of sulphate of soda in the carbonate is to heat a small quantity of carbonate of soda upon charcoal, in the reduction flame, until it is entirely absorbed. Cut out, with a small knife, this part of the charcoal, and digest it in water; to the solution add a small piece of bright metallic silver; if sulphuric acid had been present the surface of the silver would become first yellow, then brown, and finally black.

The carbonate of soda, in qualitative examinations with the blowpipe, serves to determine—first, whether a body fuses or is rendered soluble; second, the presence of silicic acid in combination; and third, to reduce metallic oxides.

In quantitative analyses it serves as the means of rendering soluble silicic acid, tungstic acid, and titanic acid in combinations; and, also, for quickening the reduction of different metallic oxides.*

2. *Biborate of Soda.*—This salt, which is met with in commerce in large masses, must be re-crystallized, to free it from foreign matters. If the crystals yielded are pure, they will give a transparent glass when heated upon the ring of a platinum wire. In quantitative analyses, owing to the crystals occupying so much space when heated, on account of their intumescence, the borax must be employed in a calcined state. According to Berzelius almost all substances dissolve when fused with borax, and form, with its ingredients, acid and basic combinations; for this reason it is such a valuable flux in blowpipe experiments.†

3. *Phosphate of Soda and Ammonia.*—This salt is best obtained by heating together, in distilled water, 100 parts of crystallized phosphate of soda, with 16 parts of sal-ammoniac. Chloride of sodium separates; and the liquid, when filtered and evaporated, affords the salt in fine crystals. When this salt is heated upon charcoal, or platinum wire, it loses its water and ammonia, and is converted into metaphosphate of soda, which, in consequence of its excess of acid, has the power of fusing almost every chemical compound.

This salt, in the liquid state, detects magnesia and the protoxide of manganese.

GENERAL RULES BY WHICH THE INGREDIENTS OF MINERALS, &C., MAY, FOR THE MOST PART, BE DETECTED WHEN HEATED ALONE OR WITH REAGENTS IN THE BLOWPIPE FLAME.

It is always advisable, before commencing an analysis, to spread a sheet of clean white paper upon the table, in the middle of which the blowpipe-lamp is placed; by this precaution any substance falling from the charcoal or wire can be recobtained, and the investigation continued. If it is of any consequence that the table be preserved from the hot falling assays, three or four sheets must be employed. The presence of foreign matter upon the paper must be particularly guarded against, otherwise, on a bead falling and coming in contact with it, a false result would necessarily follow. Clean paper should be employed for each analysis.

With respect to the quantity of the substance which should be employed, when seeking its behaviour alone with the reagents before the blowpipe, it is always advisable that too much be not

* [The best method of preparing a large quantity of bicarbonate of soda is to pass a stream of carbonic acid gas over an atomic mixture of crystals of soda and the dry carbonate. Great heat is evolved during the process, owing to the rapidity with which the gas is evolved]—Trans.

† [Graham remarks that the anhydrous salt is very fusible by heat, and forms a glass. This glass possesses the property of dissolving most metallic oxides, the smallest portions of which colour it.]—Trans.

taken. If, for instance, an analyst wishes to examine the solubility of an earth, mineral, &c., with borax or microcosmic salt, on the platinum wire, a piece about the size of a mustard seed is taken. In cases where metallic oxides are present, and the colour only of the bead or glass is sought, considerably more is used, and in a pulverized state; but if it is the reduction of a metal by means of soda upon charcoal a still larger quantity is employed, and also in a powdered state. Experience, however, soon teaches the proportions to be used in the different occurring cases. If too much substance be employed, it inevitably follows that uncertain results are the consequence.

In examining the relation of a substance by itself, or with fluxes before the blowpipe, the operator proceeds as follows:—

(*a*) A part of the substance to be examined is gradually heated to redness, in a small glass retort, over the spirit-lamp. During this process all phenomena must be observed,—if decrepitation takes place; if water or any other volatile body be eliminated, and its odour. The water condensed in the cooler parts of the retort should be tested by litmus or brazil wood paper, to ascertain if it gives an acid or alkaline reaction.

(*b*) Another portion is heated gently upon charcoal before the blowpipe flame: the odour will indicate volatilized acids, arsenic, selenium, or sulphur. The difference of smell should be noticed when the sample is heated in the oxidating as well as in the reducing flame, since selenium and sulphur are best detected in the former, and arsenic in the latter. It should be noticed if the charcoal has become coated with a sublimate, and if near or at a distance from the assay; of what colour it is, and if it remains the same when cold as when hot. If the substance under examination be an earth, it must be heated strongly for some time, and then removed from the charcoal to litmus paper, and moistened with a few drops of distilled water; if an alkaline reaction occurs, the substance contains a carbonate of one of the alkalis; for these occur in nature, witherite, strontianite, calcareous spar, magnesite, bitter-spar, &c., and become caustic with strong heating, and exhibit alkaline properties.

(*c*) If the substance contains volatile metals, metallic oxides, sulphur, &c., it is examined in a tube which is open at both ends. The substance is placed within the tube, at a short distance from one end, which is then heated with the spirit-lamp, and afterwards with the blowpipe flame. The tube is held in an inclined position. The more perpendicular the position, the stronger the current of air. It is very easy to regulate the rapidity of the draught according to the rate of oxidation that may be required.

In this treatment many substances are sublimed, which were not when heated in the retort, because the access of air was comparatively small. The oxygen of the air is absorbed, forming volatile acids or metallic oxides; some escape as gases, and may easily be recognised by their smell,—sulphur, for instance, exhaling sulphurous acid. Others are deposited in the upper and cooler parts of the tube, at greater or less distances from the heated body, according to their degrees of volatility; in the cases of arsenic and antimony, for example, the former is given off as arsenious acid, and the latter as oxide of antimony.

(*d*) In examining a substance with regard to its fusibility, a part is placed in a small cavity, formed in a piece of charcoal, and heated for a length of time in a strong oxidating flame. The more easily-reduced metals and metallic oxides are acted upon in this experiment.

If the substance be an earth or silicate, small pieces of it are broken off with a hammer, and a piece chosen with a sharp point or side. This is held between the platinum points of a pair of forceps, and a strong blowpipe flame allowed to play on the sharp extremity for some time. It will at once be seen if the substance is fusible or not. If infusible, the sharp point or edge will remain unaltered; if fusible, it becomes rounded; and if entirely fusible, it will melt into a round bead. These appearances should be examined through a strong magnifying-glass. When a splinter is heated in the inner flame, the outer may become coloured. For instance, if the mineral contains potash or soda; with potash, the outer flame will be violet; with soda, yellow.

If lithia, without soda, it will be tinged red. If the three are present the yellow flame predominates.

Berzelius treats those minerals which are found to be very infusible in the following manner. The substance is levigated in an agate mortar with water. The menstruum, with the finely-divided particles floating through it, is dropped on the charcoal, and heated by the oxidating flame, to evaporate the water. This operation is repeated until the charcoal becomes covered with a coating of the fine particles, which are carefully collected and held in the points of the forceps, and then subjected to a powerful oxidating flame. For the most part some change takes place, owing to the extreme divisibility of the mineral, showing that the substance is not altogether infusible. In this case the microscope will be in great requisition, in order to discern the action which may have been produced.

When the substance occurs in a granulated state (such as sand), one of the grains should be placed on the charcoal; but, as this is so apt to be lost, the better way is to knead the substance with water into a paste, which is then placed on the charcoal, dried by the oxidating flame, and examined as to its fusibility. This manner should always be resorted to when treating substances that are in a minute state of division. —*Plattner on the Blowpipe.*

MISCELLANEA.

SELECT RECIPES, &c.

Ambergris Wash-balls.—Take 16 pounds of the best Joppa or the whitest Alicant soap, cleansed well from dirt and lime. Shave or scrape it very thin, and expose it to the air for several days. Now have ready mixed 2 pounds of ambergris powder, 1 pound of musk and civet powder, ½ pound of fine starch-powder, and ½ pound of Florentine iris-powder: all of which are to be well incorporated with the soap. Then take 20 grains of pure musk, 20 grains of civet, and 30 or 40 grains of the remains of musk and ambergris spirit. Grind all these to a very fine powder, with loaf-sugar, and add to them, whilst in the glass mortar, 2 ounces of spirit of ambergris, 1 ounce of spirit of musk, 20 drops of oil of rhodium, and ¼ ounce of apoplective balsam. Mix all well together, and put the whole into a quart of the remains of honey-water. Shake the mixture well, and put it into the compound of soap and powders above mentioned, and mix the whole well. This mixture must be made in an earthen pan, but by no means in a wooden vessel, which would absorb the best part of the perfumes. The incorporation of the above substances must be effected by beating very finely; and, if it is found to be too stiff for working, rose or orange-flower water may be added at discretion; still remembering that the wash-balls are to be made up as stiff as possible. They are to be dried in the shade, and are not to be touched or meddled with for a month at least, to prevent bruising or putting them out of shape. When quite dry, some manufacturers choose to gild these wash-balls on their impressions. It is impossible to make any sort of wash-ball superior to this.

Inferior Ambergris Balls.—Take the same quantity of soap as above; but, instead of 4 pounds of the compound perfumed powder, here use 6, taking care to proportion the several articles accordingly. In this case, also, it is to be noticed that one half of the perfumes prescribed for the best ambergris balls will be sufficient; and, likewise, that rose-water may be used instead of honey-water. In every other particular the previous directions are to be strictly followed.

Bologna Wash-balls,—Take 20 pounds of very old and brown Castile soap; shave or scrape it very thin, and place it in the air to dry; then add to it 3 pounds of the second remains from honey-water, in fine powder, ½ pound of cassia-wood, 1½ pound of labdanum, both finely powdered. Mix the soap and powders well together, and wet them with about 1½ pint of rose-water, and 1 pint of muddy liquid remains of honey-water. Now beat the whole well two or three times, at intervals of a few days, to let the paste become quite mellow; and then make up the mass, when stiff, into round balls, and dry them in the shade as above directed. The colour of these wash-balls will be either light brown or nearly black; or will possess the different shades of each, according to the colour of the ingredients used.

Best Marbled Balls.—Take 10 pounds of the best Genoa or rather of oil soap, made in England, and 10 pounds of Joppa soap of the whitest sort. Cut the whole into small square and triangular pieces, which set to dry for two or three days; the oil soap, particularly, must be thus dried. Then shave, or scrape, very finely, 5 pounds of oil soap, which dry for about one day in the open air, and then mix it well in the shaving-box with 5 pounds of powder, and 1½ ounce of the best and finest vermilion. In mixing, it will be necessary to place the pieces of soap, and the coloured powder, in layers in the box, making in all four alternate layers of each, beginning with coloured powder, and ending with the square and triangular pieces of soap. When a layer of each has been placed in the box or trough, 1 pint of rose-water is to be sprinkled over the upper one, namely, the cut soap; for, if it be much combined with the powder, it will cause it to become lumpy and hard, and, consequently, spoil the wash-balls made from it. The same quantity of rose-water is likewise to be used for moistening each of the other soap layers, that is, in the whole, 4 pints. Now have ready 1 pint of thin starch, which has been well boiled in ½ pint of rain water, and then mixed with ½ pint of rose-water, and distribute it equally among the whole mass; which is now to be well mixed, by turning it over repeatedly, and then to be pressed down close and even, by the hands. If a piece be now cut out, quite through the mass, the operator will perceive whether the marbling and colour are sufficiently good; and if so, he may proceed immediately to form his wash-balls. When these wash-balls have been made about two or three days, it will be time to shave off their rough coats; they are then to be left for two or three months in the air, during the summer; and, when quite dry, are to be properly shaved and weighed for sale. The shavings which come off these balls are to be kept for the next manufacture of wash-balls of the same sort. They are to be mixed with the red soap-powder, mentioned above; but, in such a case, there is no occasion to put so much vermilion as before; as, thereby, too high a colour would be produced. As to the perfume to be used for these wash-balls, the manufacturer must vary it according to taste, fancy, or the price he intends to sell his commodity for; remembering that it is to be mixed with the liquid starch previous to incorporation with the layers of soap and powder.

Inferior Marbled Balls.—Take 20 pounds of the best curdy tallow soap, shave it thin, and mix with it 4 pounds of the composition for camphor wash-balls. Beat the whole, without any water, to a fine and even-coloured paste, which will be very white. Now make this up into cakes of about an inch thick, and set them into the air to dry. Cut these cakes, when hard, into squares and triangles, as before, in the case of Joppa or oil soap, for the groundwork of the wash-balls to be manufactured. Now take 4 pounds of oil soap, 2 pounds of the coloured powder used for the best marbled balls, and 2 pounds of starch-grounds. Shave the soap, and proceed in every other respect as before. These wash-balls are to be scented with some cheap

perfume, because they are designed to be sold for about half the price of the best sort; though, in appearance, they are so beautiful, and in quality so excellent, as often to be sold for as much money as the best.

Figured Wash-balls.—These wash-balls, though troublesome to make, answer very well to surprise and please: they also may be made quite as good as any other. Take 17 pounds of the best and whitest Genoa soap, shave it fine, and mix with it 3 pounds of the composition for camphor balls. Beat the whole into a fine even paste, with rose-water. Now have ready four or five different colours, in powder, viz., a dark and a pale green, two reds, two blues, a yellow, and a brown. Then divide the paste into as many parts as there are colours at hand; and beat and mix each very intimately with its separate colour, so that the several masses may have no streaks, spots, or irregularities of hue, but may be entirely homogeneous; in doing which it is necessary to be very clean and nice. When the coloured masses are pretty stiff, roll them out into cakes on a marble slab, to about a quarter of an inch thickness; then, with tin stamps, cut them out into the shapes of birds, beasts, sun, moon, stars, &c. &c.; always observing to match the colour of the paste to the form of the stamp, viz., the quadrupeds to be generally brown; the birds to be green, or otherwise, as may be proper; the sun, golden yellow; and the moon and stars, very pale blue, approaching to white. The stamp should never exceed half an inch in size. When each cake is entirely cut out, for the first time, the shapeless cuttings, or pieces, may be again worked up separately, and rolled out and cut as before, and so on, until not a shred remains; or the cuttings may be preserved for the groundwork or field of the wash-balls. When all the figures have been properly formed, they are to be dried separately in the air, on sheets of paper, according to their colour; and then they are to be properly proportioned to the intended groundwork; for example, when the wash-ball is to be formed of birds and beasts, the field or groundwork must be green; when suns are to be introduced, the field is to be of a very pale sky-blue; and, when the moon and stars are intended to be shown, the field should be a true sky-blue, whilst the figures themselves are of a very pale blue colour. These colours, figures, and grounds, may be varied without end, according to the fancy and taste of the operator. The perfumes, the quantities of ingredients, manner of making up, and weight of balls, are exactly the same as for the best marbled wash-balls. Although, in the making of these, it will be impossible to be regular, some of the figures being broken, others whole, and all huddled together; yet, when the balls are old and properly shaved by a smooth brass knife (called a shaver), they will plainly show the intended design; and even their irregularity will both please and surprise, in the same manner that people wonder at the existence of flies and other insects in pieces of amber.

Camphor Balls.—Take 48 pounds of the best white English oil soap, or of the best sort of Genoa soap; shave and dry it very clean. Now mix with the shavings 20 pounds of the composition for camphor wash-balls, rubbing the whole together. When properly incorporated, take 1½ pound of camphor, and grind it in an iron mortar with about ½ pint of the best English Hungary water; put in, by degrees, ½ ounce of oil of rosemary, and ½ ounce of oil of lavender. When the camphor has been thus reduced to a fine powder, add to it in a mortar 4 pounds or 5 pounds of the composition above mentioned, and also the soap shavings. Beat the whole well together; and, when properly combined, take it out and mix it with the remaining quantity of composition and soap shavings; then beat it well twice over, at an interval of about ten or twelve hours. The incorporated powders are now to be kept in a well-covered earthen pan, to be made up; when the perfumer is to proceed in every respect as in the manufacture of ambergris wash-balls. Very little water is to be used in the making up of these wash-balls, and what is used should be entirely rose-water. In the making up the operator must be very quick, and he must not leave off until the rolling is completely finished; because the campor is so volatile as to evaporate surprisingly, even in the open air. These camphor-balls are to be dried well in the air.

Aromatic Pastiles.—Take a ¼ pound of storax, 1 pound of benzoin, ¼ pound of labdanum, and 1 pound of best sealing-wax. Then add to some thick gum arabic mucilage made with rose-water, 60 drops of spirit of musk, mix the whole, mould into forms, and dry.

Vinum Quiniæ Di-Sulphatis.—Wine of Di-Sulphate of Quinine.—Take 35¼ ounces of good Madeira or any good wine, 12 grains of disulphate of quinia. Dose, 4 ounces or more. This wine may be made extemporaneously by adding 2 ounces of Tinct. quin. di-sulph. to a pint of wine.

Lipsalve.—Put 8 ounces of good olive oil into a wide-mouthed bottle, and 2 ounces of the bloomy part of alkanet-root; stop the bottle, and set it in the heat of the sun till it be of a fine crimson colour; strain the oil clear into a pipkin with 3 ounces each of fine white wax, and fresh well-cleaned mutton or lamb suet; melt the whole by a slow fire, and when taken off add 40 drops of oil of rhodium or lavender, and pour it into small pots.

Black Varnish.—Take 2 ounces of lamp-black, 4 ounces of yellow resin, 8 ounces of gum sandarac, and 4 pints of rectified spirit; melt, mix, and make a varnish. Or, for old straw or chip hats: Take ½ ounce of black sealing-wax, powder it, and digest in 2 ounces of rectified spirit in a sand-heat. Lay it on warm with a soft brush before the fire.

Spruce-Beer Powders.—Take 5 scruples of white sugar, 26 grains of sesqui-carbonate of soda, and 10 grains of essence of spruce, for the blue paper; and ½ drachm of tartaric or, what is bester, citric acid, for the white paper. Dissolve in separate glasses of water; mix, and drink immediately. Or, it may be made as directed for ginger beer with soda and sulphuric acid.

Spruce Beer.—Add 4 drachms of essence of spruce to 10 gallons of water, 6 pounds of sugar for white, and treacle for brown, spruce; add also yeast in the same way as for ginger beer, and bottle up.

Hungary Water.—When genuine this is a spirit distilled from rosemary, and is prepared as follows:—Take 30 gallons of spirit of wine, put to it in a large still 6 large bunches of fine fresh rosemary leaves and flowers in full blow, and stripped from the wood and twigs, 1 pound of lavender flowers, and 4 ounces of the best oil of rosemary; digest for twenty-four hours, and distil, drawing off 25 gallons. Keep this in a close copper vessel for a month.

Fictitious Sherry.—Sherry may be imitated as follows:—Boil 32 pounds of white sugar and 10 pounds of sugar-candy in 16 gallons of water; then boil half a bushel of pale ground malt in 6 gallons of water, macerate, strain, and add it to the former with 1 pound of yeast. Three days after add 10 pounds of stoned raisins, and in three days more a gallon of brandy. Let it stand in the cask for four months, when it must be drawn into another cask, and another gallon of brandy added. After three months it may be bottled.

New Description of Steam-Engine.—M. Beauregard, a Parisian engineer, has constructed a small steam-engine of one-horse power, the boiler of which is so small that it can be conveniently carried in the pocket, and the vapour of water in its spheroidal state has been employed to move it. This condition of water is produced by its being projected upon a metal plate at a dull red heat, in which case it forms itself into a sphere, and rolls over the heated surface, evaporating more slowly than when boiled in the usual manner. In the experiments of M. Beauregard the boiler is placed in a bath of melted lead, and water, in small quantities at a time, is projected upon its surface, which is sufficiently heated to produce the spheroidal condition. The elasticity force of the vapour given off is said to be far superior to that of steam in its ordinary conditions.—*Scottish Railway Gazette.*

Submarine Communication between England and Ireland.—The more speedy transmission of intelligence across the Irish Channel, and improved means of communication between the sister islands, will be secured by the determination of the Government to take advantage of the facilities afforded by the submarine electric telegraph. The Lords Commissioners of the Admiralty have given permission to Mr. Charles Blunt, civil engineer, to effect a communication by laying down his submarine electric telegraph between Holyhead and Dublin. The telegraphic wires will be connected with the lines of railway radiating from the Irish metropolis and with the Chester and Holyhead Railway in this place; and we understand that convenient positions at both the termini have been chosen and marked out where the wires will terminate. The Admiralty are desirous to furnish Mr. Blunt with the necessary aid, and for this purpose have authorized Captain Fraser, R.N., the commanding officer of her Majesty's naval establishment at Holyhead, not only to permit the former gentleman immediately to commence his operations, but also to afford every assistance which he may require in the performance of his undertaking. This desirable enterprise will form another link in the great chain of communication between the two countries. By its means space will be almost annihilated, and in a few minutes the most important political intelligence, or the minutest detail of business, will be conveyed between the capitals of England and Ireland. The towns of Liverpool and Manchester would also be benefited, as the telegraphic communications would be at least twelve hours in advance of the ordinary mails.—*Globe.*

Botanical Society.—The 12th anniversary meeting was held on Wednesday evening at the society's rooms, 20, Bedford-street, Strand, Mr. J. E. Gray, F.R.S., president, in the chair. From the report of the council it appears that 25 new members had been elected since the last anniversary, and that the society now consisted of 217 members. The distribution of the valuable British and foreign specimens to the members during the present year had given the greatest satisfaction, and increased exertion had been made this season to obtain the more interesting plants which had been attended with success; while great progress had been made in the arrangement of the British Herbarium. The report was unanimously adopted, after which a ballot took place for the council for the ensuing year, when the chairman was re-elected president, and he nominated Mr. J. Miers, F.R.S, and Mr. E. Doubleday, F.L.S., vice-presidents; Mr. J. Reynolds and Mr. G. E. Dennes, F.L.S., were severally re-elected treasurer and secretary.

Musk.—The musk deer, from the male of which animal species the bag containing this valuable drug is obtained, is a native of the mountainous Kirgesian and Langorian steppes of the Altai, on the river Irtish, extending eastwards as far as the river Jenesi and Lake Baikal; and generally of the mountains of Eastern Asia, between 30° and 60° N. lat. Two distinct kinds of musk are known in commerce, the first being the Chinese Tonquin, Thibetian, or Oriental, and the Siberian or Russian. The Chinese is regarded by Dr. Goebel as the result of ingenious adulterations of the genuine article by that crafty people. The Russian musk is genuine; the bags never being opened are, consequently, never sewn, nor artificially closed, like those imported into London from China. The former is sometimes so fresh that moisture may be expressed from the bag by cutting through its fleshy side. The interior mass is frequently of a soft and pappy consistence; but the surface of the bag is perfectly dry. The Chinese bags are found, invariably, to have been

opened and again glued together, more or less neatly; though sometimes the stitches of the sewing are manifest. Mr. Dyrssen, an eminent merchant at St Petersburg, states that during the many years he has been in the trade, although he has received, at a time, from 100 to 200 ounces from London, yet in no case whatever has he met with a bag which had not been opened, and closed with more or less ingenuity. The genuine contents seem to have been first removed, modified, and replaced. M. Guibourt gives the following as the constituents of a Chinese musk-bag:—1. water; 2. ammonia; 3. solid fat or stearine; 4. liquid fat or elaine; 5. cholesterine; 6. acid oil, combined with ammonia; 7. volatile oil; 8—10. hydrochlorates of ammonia, potassa, and lime; 11. an undetermined acid; 12. gelatin; 13. albumen; 14. fibrin; 15. carbonaceous matter soluble in water; 16. calcareous salt; 17. carbonate of lime; 18. hairs and sand. From June, 1841, to June, 1842, a duty of 6d. per oz. was paid at the port of London alone upon 969 ounces of musk. The price of grain musk of the best quality (the matter without the bag) varies from 60s. to 95s. per ounce. There is a superior musk imported now from the United States, which is nearly free from the carbonate of lime, so abundant in the bags of the Siberian musk.—*Ure's Supplement to Arts, Manufactures, and Mines.*

To Prevent Incrustation in Steam Boilers. M. Cave, a manufacturer of steam-engines in Paris, is said to have discovered a simple means of preventing incrustation in steam-boilers, the use of which has been attended with very excellent results. As the result of some experiments on the comparative effects of different substances, particularly various kinds of woods and barks, and more especially oak bark, he has been led to try simply the effect of logs or billets of oak placed in the boilers. The success of this experiment is said to have exceeded his expectations; not only did the salts contained in the water form no incrustation, they do not show even a tendency to adhere to the boiler. This method is not more simple than economical. It is sufficient, according to M. Cave, to replace the logs of wood once a fortnight, when the boiler is emptied. [If M. Cave's plan possess any value it must be purely due to the mechanical agency of the billets of wood, which, by continually striking against the sides of the boiler, impelled by the commotion of the boiling water, may dislodge or prevent the formation of incrustations.]

TO CORRESPONDENTS.

☞ Correspondents are respectfully informed that all important questions which we are unable to answer ourselves shall appear in the correspondents' list, where they will generally elicit the necessary information.

"N. P. O."—We can make no arrangements, pecuniary or otherwise, with any gentleman for serial articles until they have been submitted to us for inspection.

"Mr. D. Walker."—In reference to your query of last week we have received a note from Mr. William Higgs, of 69, Lillington-street, Vauxhall-road, who can give you some important information relative to liquid manures.

"An Old Subscriber, Holywell."—Mr. A. P. Halliday, of Combrook, Hulme, Manchester, thus addresses on the subject of your query:—"Dear Sir,—I noticed in the *Chemical Times* of Friday last an inquiry from an old subscriber, Holywell, as to the best mode of using profitably three tons of boxwood sawdust which he has going to waste weekly. My attention has for some years been turned to the subject of using up waste materials in the manufacture of pyroligneous acid. My method is the subject of a patent, and, if you think it worth while for your Holywell correspondent to communicate with me, he may have the opportunity of becoming acquainted with my plan."

"Mr. Thomas Pooley Mawe, 19, St. John's-grove, Richmond, shall have the journal regularly in future. The change of office and the increased sale of the journal have, together, produced a little primary irregularity.

"A Correspondent from the Commencement."—By direct experiment we have ascertained that a sample of the Liquor Plumbi Diacetatis of the London Pharmacopœia contains 140 grains of the salt, which, in fact, being a tri, and not a di, acetate, as it is called in the Pharmacopœia, is composed of acetic acid and oxide of lead, in the ratio of 51 to 336, *i.e.*, 1 eq. of acid to 3 of oxide.

"Mr. Longbottom."—The journal has been forwarded.

"M. O. M."—The question is rather legal than chemical, but we should think not.

"B. T. N., of Islington," is sincerely thanked for his kind remarks. We are glad to have merited his approbation.

"A Dublin Brewer."—Mr. Aitken's specification of a means of keeping fermented liquors was sealed March, 1830. It is as follows:—"My improvements consist in particular means of preserving for use beer, ale, cider, wine, or other fermented liquors. All such liquors contain in them quantities of carbonic acid, and of spirit or alcohol, which quickly escape from them whenever they are exposed to the air, and are freed from the pressure of a confining vessel; the first with the appearance of frothing; the second invisibly; and it is usual, therefore, to preserve them in close casks perfectly filled, or in well-corked bottles. The latter is the suitable mode when they are to be used in small quantities at a time, both because it allows a stronger pressure to be maintained on the liquor in proportion to the smallness of the containing vessel, and because it prevents the loss or deterioration, by escape, of the gas from any large quantity of the liquor that might be left unused at the time. Now, any contrivance which, with other advantages, should save the great expense of bottling, by allowing brisk liquors to be kept in bulk, so that portions might at any time be taken away for use, without injury to the remainder, would be of great importance. This is the character of the new means which constitute my invention: were it impossible to cause a cask or bottle to diminish when part of its contents were removed, so as to remain still full, and to compress the remainder as strongly as it originally compressed the whole, the end would be answered; and this may really be done by making the cask or vessel cylindrical, like a common pump barrel, with a close-fitting piston, to follow the remaining liquid, on any being drawn off, so as always to maintain the same pressure: but as there are many objections to such an apparatus, as of expense, difficulty of execution, &c., I obtain the same result by using common vessels, of unchangeable size, into which, as liquid is withdrawn from them, I either force something of equal bulk with such liquid, or I use the carbonic acid gas generated in the liquid itself, so as to answer the purpose."

"Mr. James Ross."—The preparation called roseate powder is sold as a depilatory for removing superfluous hair, and composed of 1 ounce of orpiment (sulphuret of arsenium), and 10 ounces each of quicklime and starch. It is, therefore, a powerful escharotic, and should be used with great caution.

"A Builder."—Newall and Co.'s copper wire cord may be procured in London at 130, Strand, and 163, Fenchurch-street. We consider it a beautiful manufacture, and very well adapted for your purposes.

"Mr. H. Brough, Limerick."—The French physicians prescribe indigo in phthisis, diarrhœa, and immoderate flow of the lochia, as an astringent: it has also been prescribed with advantage in epilepsy, but its chief use is in dyeing.

"Mr. T. Parsons."—Battley's Liquor Opii Sedativus is mainly composed of acetate of morphia, and may be imitated by macerating with tartaric acid the dregs left after making tincture of opium.

"Mr. T. Jefferson."—Copal is brought from America and the East Indies: it is used chiefly for making varnishes, though sometimes it enters into the composition of plasters. The best copal is hard, brittle, in rounded lumps, and easily reduced to fine powder. Copal often contains, like amber, insects. Copal is often adulterated with anime, which is very like copal, but of very inferior value in varnishing. Anime readily dissolves in spirits of wine, which the copal does not. Copal is difficultly soluble in alcohol and essential oils. It is more soluble, however, in an alcoholic solution of camphor, or it may be dissolved with considerable facility in alcohol alone, provided it be heated over the fire before adding it to this menstruum. To dissolve copal in oil of turpentine, take 2 ounces of oil of lavender, heat it in a glass matras, and add gradually an ounce of copal, grossly powdered, stirring the mixture with a stick of white wood. When the copal is dissolved, add 6 ounces of oil of turpentine, nearly boiling, and stir the whole well.

"A Dispenser."—Salicine was discovered by M. Leroux in willow and poplar bark. It is made up of white, silky, pearly, crystals, and possesses febrifuge properties. It is sometimes used as a substitute for quina. Dose, from 6 to 30 grains.

"A Sufferer from Rheumatism."—The leaves and root of the buttercup, or crowfoot, Ranunculus acris, are used in form of cataplasm in gouty and rheumatic pains of the joints, and applied for eight or twelve hours to the wrists to prevent an accession of intermittent. Let not our correspondent quack himself, but apply to a respectable medical practitioner.

"A Valetudinarian."—Reynolds's specific for gout and rheumatism is an exact copy of a formula published by Want. Take 8 ounces of the fresh bulb of colchicum, 16 ounces of sherry wine; macerate for eight or ten days in a gentle heat. Syrup of poppies is added as a colouring matter, and rum as a flavouring agent. Let our correspondent beware of those nostrums containing colchicum as an ingredient. Reynolds killed himself by an overdose of his medicine.

"A Yorkshire Druggist."—Squire's elixir, a nostrum of which there are many formulæ, all, however, containing opium. The following is the most usual:—Mix 20 drachms of opium, 1 ounce of camphor, 1 drachm each of carbonate of potass and cochineal, 2 ounces of burnt sugar, 1 pint of tincture of snakeroot, 2 gallons of spirit of anise, and 8 ounces of sulphate of tin.

"Mr. E. H. Durden's" request shall receive attention.

A member of the Pharmaceutical Society sends us a letter in which he severely animadverts on the incompetence displayed by certain teachers attached to that institution. "I, a member only of the Pharmaceutical Society" (God save the mark!), writes our correspondent, "can see no difficulty in accounting for the blackness which occurs when chloroform is acted on by oil of vitriol, when I consider that the liquid contains carbon, hydrogen, and oxygen. Mr. ——, a *professor*, cannot account for this!"

"Chemicus" sends us the following note. Perhaps some correspondent will favour us with the result of his practical experience:—"Sir,—Will you kindly oblige me by an answer to the following query through the medium of your valuable journal?—Bichromate of potash and sulphuric acid have been used to bleach tallow by a melter in . . . .; but, although he finds the chromic acid produced from these ingredients bleach his tallow admirably, he cannot succeed in separating the sediment thrown down by them from the tallow, and consequently he loses a considerable portion of his bleached tallow, and defeats his object, which is economy. Can you inform me what is the most feasible way of doing this? Or can you inform me of any better way of bleaching tallow than the one tried? If you can afford the time and a little space in your journal, you will confer a great favour on your obedient servant and constant reader."

"A Gunpowder-manufacturer."—We shall give a detailed account next week of M. Violette's process of charring wood in a cylinder by transmitting through it a current of high-pressure steam.

"A Correspondent" asks whether, "now that quinine is so much advanced in price, an active principle cannot be obtained (equally if not more beneficial than quinine) from calumba-root? I should be glad to see you write on the subject, calumba is now so cheap."—Our correspondent must not infer that all vegetable bitters possess identity of medical qualities. Calumba-root will not answer the purposes of cinchona bark.

"Mr. N. Jackson, Perth."—The term vitriol was originally applied to sulphate of iron, which was called green vitriol; to sulphate of copper, which was called blue vitriol; to sulphate of zinc, which was called white vitriol; and to sulphuric acid, which, when impure, was called oil of vitriol, or, when colourless, simply vitriol, or spirits of vitriol. In common parlance these terms are still extant, especially in the country. Sulphate of iron is also called in some places copperas, and sulphate of copper bluestone. The term copperas leads parties unacquainted with chemistry to infer that it is a preparation of copper.

"Mr. Thomas Gordon, Belfast."—Powdered glass is employed in veterinary practice to remove specks from the cornea of horses. It is, however, a most dangerous remedy. It is also used to adulterate snuff.

"Walker's Jesuit's Drops" are composed of 1 pound of gum guaiac, 3 drachms of balsam of Peru, 2½ pints of rectified spirit. Make into a tincture. Dose, 1 drachm to 2 drachms as an antivenereal. It is also called the balsam of guaiacum and occasionally the antivenereall elixir.

"Mr. Charles Eccardt" should procure M'Culloch's "Commercial Dictionary."

"A Perfumer."—Rouge is thus prepared:—Take 4 ounces of prepared French chalk, 2 drachms of almond-oil, and 2 drachms of carmine. Mix till thoroughly incorporated. Or, take 4 drachms of safflower, washed in water till it comes off colourless, and dried: 1 drachm of bicarbonate of potass; 1 pint of water. Macerate, filter, and add a little French chalk, scraped fine, with 4 ounces of Dutch rushes, on which the rouge is to be precipitated with lemon-juice or citric acid. Safflower, Cnicus tinctorius, Carthamus tinctorius, is also called bastard or dyers' saffron. The dried flowers are the parts of the plant used in dyeing.

"A Housekeeper."—It is a vulgar error to suppose that soy is made from blackbeetles. It is prepared according to the following receipt from a bean which in form is not unlike a blackbeetle. Hence the mistake:—Boil 1 gallon of the seeds of Dolichos soya till soft; add then an equal quantity of bruised wheat, and keep the whole in a warm place for a day or more. Then, with 1 gallon of salt and 2 gallons of water, cork it up in a stone jar for three months, shaking it frequently, then press out the liquor. Soy may be imitated by using peas or kidney-beans for the seeds of the Dolichos soya.

Communications have been received from Mr. Noad, Mr. R. Jackson, Mr. Thomas Gordon, Mr. Charles Eccardt, A Perfumer, A Housekeeper, Mr. H. Brough, Mr. T. Parsons, Mr. T. Jefferson, A Yorkshire Druggist, A Valetudinarian, A Dispenser, A Sufferer from Rheumatism, Mr. James Roy, A Builder, Chemicus, A Gunpowder Manufacturer.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—December 9, 1848.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,*
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture III.

When the hydrogen of the organic compound is replaced by its equivalent of oxygen or chlorine, we have an analogous compound of a similarly composed radical; sometimes, however, there results new compounds of a more simple radical. Hydrate of the oxide of acetyle, $C_4 H_3 O + Aq$, when acted upon by chlorine gives rise to chloral, and other compounds of chlorine:—

Hydrated oxide of acetyle, $C_4 H_3 O + Aq$
Chloral, $C_4 Cl_3 O + Aq$

We find that the whole of the hydrogen in the aldehyde is displaced by chlorine, a new radical, $C_4 Cl_3$, similar in all respects to acetyle, $C_4 H_3$, being formed.

Chloral is generally obtained by treating alcohol with chlorine. Great care must be exercised in the process, and weak spirits of wine employed:—

$$C_4 H_5 O + HO + 8Cl = C_4 Cl_3 O + HO + 5H Cl$$

This substance possesses a strong and peculiar odour, productive of lachrymation. If we oxidize alcohol, *i.e.*, substitute for its hydrogen five atoms of oxygen, two atoms of oxalic acid are obtained. Dr. Hofmann and myself noticed the production of oxalic acid from alcohol when pistilling nitrobenzide with an alcoholic solution of potassa. The oxalic acid must have been formed at the expense of the oxygen in the nitrobenzide, two equivalents of which, with one equivalent of alcohol, contain the elements of one equivalent of azobenzide, one equivalent of aniline, two equivalents of oxalic acid, and two equivalents of water.

Nicholson also observed oxalic acid when acting upon nitrocumol in the same way:—

$$\underset{\text{Nitrocumol.}}{2\,(C_{18} H_{11} NO_4)} + \underset{\text{Alcohol.}}{C_4 H_5 O, HO} = \underset{\text{Azocumol.}}{C_{18} H_{11} N} + \underset{\text{Cumidine.}}{C_{18} H_{13} N} + 2\,(HO, C_2 O_4) + 2\,Aq$$

$C_2 O_3$ is the formula for oxalic acid, the oxide of a more simple radical than chloral.

The substitution theory is a most important one, and extremely interesting, for we find chlorine taking the place of hydrogen without changing the general character or type of the compound. In my last lecture I gave you an instance of oxygen being replaced by sulphur in mercaptan, a body possessing the greatest similarity with alcohol, from which it is indirectly prepared. What do we learn from such substitutions? Why, that the behaviour of a substance does not so much depend upon the idiosyncrasy of its elements as upon their mode of arrangement. I have told you that chlorine and sulphur can take the place of hydrogen and oxygen, and there cannot be the slightest doubt as to the almost interminability of such replacements. Prominent examples have been explained, and we may infer that similar substitutions will occur with bromine, iodine, and peroxide of nitrogen. The striking facts brought to light by Liebig, Hofmann, and Laurent throw a simplicity and beauty over the constitution of matter, and these eminent chemists are daily dragging from their hiding-places compounds of intense scientific interest.

Before proceeding further with certain organic compounds we will enter more minutely upon the statements set forth in my first lecture, that all organic compounds consist chiefly of carbon, hydrogen, oxygen, and nitrogen. By far the greater number of organic bodies contain only three elements, carbon, hydrogen, and oxygen; a less numerous class has four, carbon, hydrogen, oxygen, and nitrogen; and very few consist of five, carbon, hydrogen, oxygen, nitrogen, and sulphur. We find, therefore, that nearly all organic substances contain the same elements; and withal how miraculous is the variety of their behaviour? What appears paradoxical with regard to organic substances, some of them have the same elements in the same proportions, differing, however, materially in properties. This we can only account for by supposing that the arrangement in their atoms is different. One of the most remarkable facts we are acquainted with is, that aniline has been described by different chemists under five different names, aniline, benzidam, crystalline, cyanol, and phenamide. Hofmann proved the above-named substances to be identical. Such accurate chemists are much wanting, for with them the present host of organic substances will be greatly decreased. Aniline is obtained in abundance from coal-gas naphtha; so is carbolic acid, a body which has been regarded by Laurent as the hydrate of an oxygen compound of an organic radical, $C_{12} H_5$ (Phen). Now, aniline may be regarded as an amide of the same radical:—

$$\underset{\text{Aniline.}}{C_{12} H_7 N} \text{ or } \underset{\text{Phenamide.}}{C_{12} H_5 + NH_2}$$

The preceding examples have been introduced for the sole purpose of impressing upon you the importance of the radical theory in exposing and simplifying the constitution of organic bodies. When the theory was first introduced great discussion was the result. Oppositionists exclaimed, "Exhibit to us your radicals, compound radicals, &c., and we will believe you." The isolation of all radicals may be, perhaps, for ever impossible; but, in the words of the illustrious Liebig, "happily for the progress of science, it is quite unnecessary to isolate them, in order to be sure of their existence."

How long did we assume the existence of the compound radical methyle ($C_2 H_3$)? For many years. The beautiful investigations of Kolbe and Frankland now prove that $C_2 H_3$ can be obtained in the form of gas by acting upon the cyanide of ethyle with potassium.

There are other kinds of compound organic radicals as well as those mentioned, such as benzile and cinnamile. The former obtained when chlorine or nitric acid acts upon benzoine, a substance formed by the action of alkalis upon the oil of bitter almonds. When chlorine gas is passed over molten benzoine, hydrochloric acid escapes, while benzile remains behind:—

$$\underset{\text{Benzoine.}}{C_{14} H_6 O_2} + Cl = \underset{\text{Benzile.}}{C_{14} H_5 O_2} + H Cl$$

It is obtained perfectly pure when crystallized from alcohol.

Cinnamile is the hypothetical radical of oil of cinnamon and cinnamic acid:—

	Formula.	Symbol.
Benzile.....	$C_{14} H_5 O_2$	BZ
Cinnamile.....	$C_{18} H_7 O_2$	Ci

When the two radicals assume more oxygen, we have:—

Benzoic acid.. $C_{14} H_5 O_3$, or BzO
Cinnamic acid $C_{18} H_7 O_3$, or CiO

We may suppose the third atom of oxygen in the benzoic acid, as substituting hydrogen, for the volatile oil of the bitter almonds is the hydride of benzile, the compound radical of benzoic acid:—

Hydride of benzile $C_{14} H_5 O_2, + H$
Benzoic acid..... $C_{14} H_5 O_2 + O$

The hydrogen may in like manner be replaced by bromine, iodine, sulphur, cyanogen, and chlorine, giving rise to the following interesting series appended:—

Hydride of benzile.... $C_{14} H_5 O_2 + H$
Bromide of benzile.... $C_{14} H_5 O_2 + Br$
Iodide of benzile..... $C_{14} H_5 O_2 + I$
Sulphide of benzile.... $C_{14} H_5 O_2 + S$
Cyanide of benzile ... $C_{14} H_5 O_2 + Cy$
Chloride of benzile.... $C_{14} H_5 O_2 + Cl$

The following question, perhaps, occurs to you as I have displayed the above formulæ. Can the chlorine or iodine, &c., be replaced by oxygen? Certainly. When the chloride of benzile is distilled with potassa, chloride of potassium and benzoate of potassa are formed:—

$$\underset{\text{Chloride of benzile.}}{C_{14} H_5 O_2 + Cl} + KO = \underset{\text{Benzoic acid.}}{C_{14} H_5 O_2 + O} + K Cl$$

If $C_{14} H_5 O_2$ be a true organic radical, it should combine with other bodies besides those in the above table. This also takes place:—Amidogen, NH_2, combines with benzile, and we have benzamide, or the amide of benzile; amidogen, Ad, taking the place of the hydrogen in the oil of bitter almonds:—

Hydride of benzile .... $C_{14} H_5 O_2 + H$
Benzamide ..... $C_{14} H_5 O_2 + Ad$

Every step we take shows us more clearly the great use of the assumption of radicals where they have not been isolated. We classify substances with such precision that with a little care numerous types of compounds can readily be represented. If we use empirical formulæ we imply no theoretical idea as to true chemical relations. To give you an example of this I will exhibit the empirical formulæ of acetic acid and chloracetic acid:—

Acetic acid ..... $C_4 H_4 O_4$
Chloracetic acid..... $C_4 Cl_3 O_4 H$

We cannot in the preceding recognise any great or striking analogy, whereas if we admit, in the conversion of ether into acetic acid, that a new radical, acetyle ($C_4 H_3$), has been produced, the teroxide of which, with one atom of water, constitutes acetic acid, we have, by withdrawing the hydrogen of the radical, and placing in its stead chlorine, a body extremely like acetic acid in its constitution:—

Acetic acid..... $C_4 H_3 O_3 + HO$
Chloracetic acid..... $C_4 Cl_3 O_3 + HO$

As the comportment of acetic and chloracetic acids is so analogous, they can be embraced in the same chemical group. Chloral and aldehyde form another similar type:—

Aldehyde ..... $C_4 H_3 O + HO$
Chloral ..... $C_4 Cl_3 O + HO.$

[*To be continued.*]

* Dr. Scoffern's Paper on Sugar next week.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXVI.

(LECTURE LXIV.)

FATS AND FIXED OILS—(*Continued*).

Section III.

SUBSTANCES IN WHICH THE FATTY MATTER IS ASSOCIATED WITH AN ESSENTIAL OIL.

This section comprises the following substances:—

Nutmegs and mace,
Bay-berries (laurel-berries),
Musk,
Ambergris,
Castoreum.

NUTMEGS AND MACE.

Nutmegs are the seeds of the nutmeg-tree (Myristica moschata).

Mace is the middle husk of the nutmeg.

These two substances owe their properties entirely to the volatile oil which they contain. They are used in medicine as energetic stimulants.

The nutmeg contains:—

Myristine,
Oleïne,
Volatile oil,
An acid,
Starch,
Gum.

Henry found in mace:—

Volatile oil,
A fixed yellow-coloured oil, insoluble in alcohol,
A fixed red-coloured oil, soluble in alcohol,
A gummo-fœculent matter.

The volatile oil of nutmeg is colourless. Its density is 0.948. It is of a viscous consistence. When mixed and agitated with water it separates, like the oil of sassafras, into two distinct oils,

viz., a fluid oil, which floats on the surface of the water, and an oily substance of the consistence of butter, which subsides to the bottom.

The volatile oil deposits in the course of time a stearoptene, which is fusible above 212° Fahrenheit, volatile, soluble in alcohol and in ether, and remarkable for the property which it possesses to dissolve in boiling water, and to crystallize from the aqueous solution upon cooling.

Myristine is a solid fatty substance, extracted from nutmeg butter by means of alcohol. It is purified by repeated solution in alcohol.

Pure myristine is crystalline, silky, white, and inodorous. It melts at 87.8 Fahr. The saponification of myristine can be effected only by fusing it in conjunction with potass: it yields under these circumstances glycerine and myristic acid; the latter fuses at 120.2 Fahr., and yields no sebasic acid upon distillation.—(Playfair.)

NUTMEG BUTTER.

Pound the nutmegs in a mortar, sift through a tolerably fine hair sieve, expose to the steam of boiling water (to soften the fatty matter), and press between hot iron plates. Let the product cool, remove all adhering moisture, melt again, and filter in an apparatus heated by boiling water.

Nutmeg butter is sometimes used alone for stimulating frictions; in most cases, however, we associate it with other remedial agents.

ALCOHOLATE OF NUTMEGS.

Take of Pounded nutmegs, 1 part.
Alcohol of 80 C. (31° Cartier), 8 parts.

Macerate for a few days, and distil to dryness.

BAY-BERRIES OR LAUREL-BERRIES.

The leaves and fruits of the laurel or bay-tree (Laurus nobilis) contain a volatile oil which imparts to them aromatic and stimulating properties.

The fruit of the laurel (the bay-berry) contains, according to Bonastre's analysis:—

Volatile oil,
Laurin,
Laurane,
A fatty green-coloured oil,
Wax,
A liquid oil,
Resin,
Starch,
Gummous extract,
Bassorin,
An acid substance,
Uncrystallizable sugar,
Albumen.

Laurin, the solid part of laurel oil, constitutes, according to Marson, a peculiar fatty principle. It crystallizes in white needles of silky lustre; it fuses at about 113° Fahr. It is very sparingly soluble in cold, but readily so in concentrated and boiling, alcohol. It is also rather copiously soluble in ether. The composition of laurin may be represented by the formula,

$$C^{27}\ H^{25}\ O^{4}.$$

Alkalis transform laurin into glycerine and lauric acid, which latter substance is fusible at from 107.6 to 109.4 Fahr.

Laurane, or laurostearine, is a white, bitter substance which crystallizes in long octahedral needles. It is exceedingly fusible. It is insoluble in cold, but not altogether so in boiling, water, to which latter menstruum it imparts a bitter taste. It is soluble in ether, and also in hot alcohol.

LAUREL OIL.

The following is the best way to prepare laurel oil:—

Take dry bay-berries, reduce them to powder, and expose the latter to the steam of boiling water for a sufficient length of time to permit its thorough penetration by the aqueous vapour. Transfer the so-prepared powder promptly to a ticking bag, and press strongly between two hot metal plates. Filter the oil hot if the temperature happens to be low. In the course of time laurel oil deposits a crystalline sediment, and acquires the consistence of half-congealed olive oil. Bay-berries yield hardly the one fifth of their weight of oil.

Most pharmacopœias recommend to use fresh bay-berries, to boil them in water, and to collect the oil as it rises to the surface. M. Menigault has tried this method repeatedly with fresh berries without being able to obtain the desired product; and I myself have found it as great a failure with the dry berry.

The best way of extracting the oil from the fresh berries is to pound the latter, to heat the mass gently, and submit it finally to the action of the press.

LAUREL POMATUM.

Take of Fresh laurel leaves,
Fresh bay-berries, of each 1 part.
Hogslard, 2 parts.

Bruise the leaves and berries, melt the hogslard in a pan, add the bruised mass, and keep digesting at a gentle heat for the space of several hours. Strain with pressure; let the strained liquid cool, and remove the dregs.

This pomatum is used for stimulating frictions, more particularly in veterinary surgery. It is frequently substituted for laurel oil, although it is less active than the latter.

CASTOREUM.

Castoreum is a secretory organ of the beaver (Castor fiber).

Castoreum has been analyzed successively by Bouillon-Lagrange and Laugier, Brandes, John, and Pfaff.

It contains:—

Volatile oil,
Castorin,
Resin,
Albumen,
Fatty matter,
Carbonate of ammonia,
Salts of soda and potass (urate, benzoate, sulphate).

Castorin was discovered by Brandes. It crystallizes in long, fascicular, diaphanous prisms. It has a coppery taste, and smells like castoreum. It is insoluble in water and in cold alcohol, but soluble in boiling alcohol and in volatile oils. It is neither acid nor alkaline.

Castorin is extracted from castoreum by the action of boiling alcohol; the castorin, which the alcoholic liquid deposits after some time, is purified by washing with cold alcohol.

Brandes ascribes the medicinal properties of castoreum to the castorine; but I think it much more probable that these properties are owing to the essential oil which the castoreum contains. Runge believes this oil to be identical with the carbolic acid (the pyrogenized oil that figures among the products of the distillation of coal).

Castoreum is used exclusively as an antispasmodic remedy. It is given in doses of from a few centigrammes to eight grammes, in pills, potions, or clysters.

DISTILLED WATER OF CASTOREUM.

Take of Castoreum, 1 part.
Water, a sufficiency.

Distil to draw off eight parts of product.

TINCTURE OF CASTOREUM.

Take of Castoreum, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Macerate for eight days; strain the liquor.

M. Personne maintains that four parts of alcohol are quite sufficient.

When intended to form one of the ingredients of a potion, this tincture should be mixed with the syrup first, since the fatty matter and resin would separate in lumps, were it added immediately to the water.

ETHERIC TINCTURE OF CASTOREUM.

Take of Castoreum, 1 part.
Sulphuric ether, 4 parts.

Comminute the castoreum as much as possible, and macerate in the ether for eight days (in a flask). Decant the etheric fluid.

MUSK.

Musk is found enclosed in a glandular organ of the Moschus moschiferus, an animal of the class of the Ruminants.

It is a very energetic agent, used as a powerful stimulant, more particularly in nervous disorders.

. The usual dose is two to eight decigrammes.

According to Guibourt and Blondeau's analysis musk contains:—

Ammonia,
Volatile oil,
Stearine,
Oleïne,
Cholesterin,
An acid combined with the ammonia,
Gelatine,
Albumen,
Fibrin,
A matter soluble in water, insoluble in alcohol,
Hydrochlorate of ammonia,
Divers salts.

Musk is usually given in pills or potions.

Doctor Hanle has made the curious discovery that bitter almonds introduced into a potion containing musk will nearly altogether deaden or destroy the smell of the latter, Now, as we do not know whether the almonds may not equally affect the medicinal properties of the musk, association of the two substances ought to be carefully avoided.

[It must appear, however, that the musk is by no means destroyed or decomposed by the bitter almonds, as its peculiar odour reappears as strong as ever the moment the prussic acid evolved from the almonds has been dissipated.]

TINCTURE OF MUSK.

Take of Musk, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Macerate for eight days; strain the alcoholic liquid.

AMBERGRIS.

Ambergris is found floating on the surface of the sea near the coasts of India, Africa, and Brazil, and is supposed to be a species of calculus or secretion formed in the stomach of the spermaceti whale (Physeter macrocephalus).

According to John's analysis ambergris contains:—

Ambreïne, 85.
A balsamic substance, 2.5.
Soluble matter mixed with benzoic acid and common sea salt, 1.5.

The balsamic substance has a sweet, acidulous taste; it is soluble in water and in alcohol; it would appear that it contains benzoic acid.

Ambreïne was discovered by Pelletier and Caventou. In its properties it presents the strongest analogy with cholesterine. It is obtained by the action of boiling alcohol upon ambergris; it crystallizes from the alcoholic liquid upon cooling.

Ambreïne is a white, insipid substance, of a mild and agreeable odour (owing probably to a small portion of volatile oil which it retains). It is insoluble in water, but soluble in ether and in alcohol. It fuses towards 86° F. It is not saponifiable. When treated with hot nitric acid it is converted into a fatty acid (ambreïc acid), resembling greatly to cholesteric acid, from which it differs, however, in its point of fusion (ambreïc acid fuses only above 212° F., whereas cholesteric fuses at 136.4 F.).

Ambergris is only rarely used in medicine; its stimulating properties are greatly inferior to those of musk and castoreum, and the other substances belonging to this series.

TINCTURE OF AMBERGRIS.

Take of Ambergris, 1 part.
Alcohol of 88 C. (34° Cartier), 24 parts.

Macerate for several days in a matras; heat to ebullition; let the fluid cool, and filter when cool.

This tincture is not by any means strong-scented, as the odour of amber requires for its

full development the association with other perfumes.

The addition of a little carbonate of soda during the maceration tends to bring out the smell of the ambergris more strongly, owing, doubtlessly, to ensuing decomposition of some ammoniacal salt, whereby ammonia is liberated, furnishing thus a vehicle for the ambergris odour.

ROYAL ESSENCE.

Take of Ambergris, 24 grammes.
Musk, 12 grammes.
Civet, 4 grammes.
Volatile oil of cinnamon, 3 grammes.
" roses,
" orange-flowers, of each 2 grammes.
Bitartrate of potaso, 6 grammes.
Alcohol of 86 C. (34° Cartier), 850 grammes.

F.S.A.

Draw off by decantation as much of the liquid as you may happen to require, and leave the remainder on the grounds.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

METHOD OF EXTRACTING NICKEL FROM COBALT, AS FOLLOWED IN A MANUFACTORY AT BIRMINGHAM.

[Communicated by M. LOUYET.]

During a visit which I made to Birmingham in 1845, I had occasion to visit and minutely inspect a manufactory invoking the use of nickel and cobalt, and for which one of these metals was employed in the state of oxide, the other in the metallic condition, and on the great scale. No one detail of the manufacture was concealed from me (although generally kept secret), because the proprietor of the establishment desired to have my opinion as to the value of the processes employed, and because he hoped, through my instrumentality, to effect certain improvements in his manufacture, which was altogether of a chemical nature. I did, in fact, succeed in being serviceable to him. Since this period, the manufacture having passed into other hands, the original proprietor cannot suffer by my disclosures, which may, perhaps, be very useful to those who desire to commence the manufacture of nickel, and of the oxide of cobalt.

The mineral employed in Birmingham is brought from Hungary: it consists principally of metallic sulpho-arseniurets, containing in general six per cent. of nickel and three per cent. of cobalt. These proportions, however, are subject to variation. The mineral is mixed with a small quantity of lime and fluor-spar, and heated to redness in a reverbatory furnace. Exposed to this temperature, the mass melts, and a supernatant scoria is obtained (removable by means of a skimmer); and a fluid mass of metallic appearance. Of these the latter material is caused to flow out, through a hole pierced in the furnace, into water, which treatment enables it to be easily broken. It is now broken into little pieces. Experience has proved that if the scoria be of a dull colour it contains iron; if, on the contrary, its surface is black and brilliant, it contains none of that metal. The metallic mass is now reduced to very fine powder, and calcined at a red heat; fusion, however, being avoided, and continued stirring being maintained.

By this process a large quantity of a resinous acid is volatilized. The air has frequent access to this mass, which becomes oxidized, and diminished in weight. The process of calcination, which lasts for the space of twelve hours or thereabouts, is continued until no more white fumes are disengaged. The residue of the calcination is treated by hydrochloric acid, which dissolves it almost entirely. The liquor is now diluted with water, and treated with cream of lime and chloride of lime mixed.*

A precipitate is formed, which after having been well washed is returned.

A current of washed hydrosulphuric acid gas is now passed through the liquor until the latter be perfectly saturated. The current of gas is stopped so soon as the addition of a small quantity of liquid of ammonia to a small quantity of the filtered liquor causes a black precipitate to subside. If the amount of hydrosulphuric acid had not been in excess, the precipitate occasioned by ammonia would have been green. The pressure of the current of hydrosulphuric acid gas throws down a precipitate from the liquor exposed to its influence. This precipitate is washed, and, as it is slightly soluble, a portion of hydrosulphuric acid is passed through the water with which it is washed. The cobalt is now precipitated by the aid of chloride of lime (hypochlorite of lime), the precipitate is washed, dried, then calcined to redness, when it is regarded as being the sesquioxide of cobalt.

Of this oxide a part finds its way into commerce; another part is heated to strong redness, which has the effect of reducing the weight but increasing the density of the result, which is now sold as protoxide of cobalt. The liquor from which the cobalt has been precipitated is treated with milk of lime. Thus the nickel is precipitated in the condition of hydrate. This precipitate is washed, dried, and calcined to redness, and, being now mingled with charcoal, is reduced to the condition of metallic nickel by the simple action of a strong heat. As regards the oxide of cobalt, it is almost entirely consumed by the manufacturers of pottery in Staffordshire. The oxide of cobalt thus obtained is of remarkable purity, being entirely free from nickel, and only costing 85 francs per kilogramme.*

ON THE PASSAGE OF HYDROGEN ACROSS SOLID BODIES.

By M. LOUYET.

[Communicated by the Author.]

By chance I have discovered some curious facts relative to the history of hydrogen gas, which have appeared to me as worthy the attention of physicians and of chemists.

If a horizontal current of hydrogen gas, emanating from a capillary orifice, be dissolved against a sheet of paper held vertically at the distance of some millimetres from the orifice, in such a manner that the current may be perpendicular to the paper, the latter is traversed by the gas. But the gas is not distributed during its passage through the paper, as might be supposed: it preserves its form of current, and may be inflamed behind the leaf equally well as if the latter were not present. Further, if a ball of spongy platinum be placed behind the paper, and in the direction of the current, the metal becomes incandescent. The platinum also becomes incandescent if the sheet of paper is placed at three or four centimetres distant from the orifice, if it be placed either close to the paper or very near it; and here I must remark that the pressure under which the phenomena are produced need not exceed that equivalent to ten or twelve centimetres of water.

To my great surprise I also found that hydrogen gas also traversed in a similar manner leaves of gold and of silver. Thus, if a ball of spongy platinum be covered with many layers of gold or silver leaf, and a current of gas be directed thereupon, the platinum ball will become incandescent, and the gold or silver leaf will adhere to its surface.

A ball of spongy platinum placed behind a layer of tinfoil, opposite to a current of gas, also becomes hot through, not to the extent of redness. Nevertheless, as the tinfoil is perforated by a number of minute holes, discoverable to the naked eye, the phenomenon is not so remarkable. But, if the leaf be doubled, still the spongy platinum ball becomes sensibly hot.

In a similar manner the current of hydrogen passes through thin membranes of gutta percha, such as are obtained by evaporating a slight film of a solution of gutta percha in chloroform.

But hydrogen gas does not effect any sensible passage through thin films of glass obtained by blowing strongly into a melted glass tube until a very thin bulb results.

ON THE SALTS OF THE PROTOXIDE OF CHROMIUM.

By A. MORBERG.

The early part of this paper is occupied with the history of the discovery of the protochloride of chromium in the reduction of perchloride of hydrogen, of which discovery M. Morberg claims priority. He found that, when red anhydrous perchloride of chromium is heated to redness with dry hydrogen, the red colour is changed into a white one, and that muriatic acid is given off. He was not, however, able to establish the composition of this white substance, as a loss of 24,737 per cent. occurred in the reduction, the theory requiring but 22,164; and the residue was found to consist, after treatment with water, of soluble protochloride and oxide of chromium. This was accounted for by the excess of temperature at which the decomposition proceeded.

Peligot having stated that this author had committed an error, with respect to the insoluble residue left by protochloride of chromium, and having ascribed its formation to the supposed occurrence of impurity in Morberg's hydrogen, the author asserts that the hydrogen in all his experiments has been prepared from pure zinc and pure diluted sulphuric acid, and passed through a U-shaped tube; the first part of which was filled with fragments of glass moistened with a solution of acetate of lead, the second with caustic potash, and the third with protochloride of tin dissolved in caustic potash. The gas was then passed through a vessel filled with pure strong sulphuric acid, and through a red-hot tube filled with red-hot copper, and finally through a U tube in which were fragments of chloride of calcium and caustic potash separated by asbestos. The gas having been thus dried entered the straight tube which contained the perchloride of calcium. To ascertain the action of the protochloride of chromium upon the perchloride, a quantity of the latter was heated in a current of hydrogen just so far that scarcely a particle was converted into the white protochloride: on adding water which had been deprived of air, the entire compound instantly dissolved. The dark green solution when concentrated over sulphuric acid yielded acicular crystals, and not granular crystals, as Peligot has stated; these were of a light green colour, and very soluble. As it was not found practicable to separate them from the mother liquor, the whole of the liquid was evaporated to crystallization, weighed, dissolved in water, and analyzed, the oxide of chromium being precipitated with ammonia, and the chlorine by nitrate of silver. The water was calculated from the loss. The following was the result of the analysis:—

Chlorine	39.405	6	39.699
Chromium	20.260	2	20.007
Water	40.335	12	40.294

The evaporation, therefore, though not the form of these crystals, coincides with that of Peligot's crystals.

The salts of chromium are barely soluble in water, *e.g.*, the anhydrous neutral sulphate of the oxide of chromium, and the sublimed perchloride of chromium, readily dissolve in water to which a little acid has been added, and in which a piece of zinc is inserted. The zinc is only acted on by the free acid. The resolvent force and the rearrangement of the acids must, it would seem, be due to the reducing effect of those substances; nor does it seem necessary to assume,

* The lime and chloride of lime (hypochlorite of lime) are added to effect the precipitation of iron and the arsenic. The chloride of lime, by peroxidizing the iron, thus enables it to be precipitated by lime.

* A kilogramme is equal to 2lbs. 3oz. 5d. avoirdupois.

as Lœwel has done, that a successive reduction takes place.

Basic Protochloride of Chromium.—Ammonia precipitates from solutions of the protochloride of chromium a substance which cannot be obtained wholly free from ammonia by washing with water; its composition could not on this account be ascertained. In vessels from which air is excluded this liquid retains its cerulean colour, but on exposure to the atmosphere it becomes ammonio-chloride of chromium. The precipitate takes a greenish colour on exposure to the air, and easily dissolves in hydrochloric acid, when, if the operation be conducted with caution, hydrogen is disengaged. To prepare the salts of the protoxide of chromium the protochloride was dissolved in water deprived of air, and precipitated with boiling solutions of salts of potash and soda. The precipitates, where obtained, were dried out of contact with the air. Bromide of potassium in solution produces no precipitate from the protochloride of chromium: the colour of the liquid becomes of a darker green. A similar reaction takes place with iodide and sulphocyanide of potassium. These solutions when exposed to air assume a brownish colour. Iodide of potassium in solution mixed with the protochloride gives a yellow or bluish-green sediment; fluoride of potassium a greenish powder.

Sulphite of Protoxide of Chromium.—The protochloride of chromium, when mixed with sulphate of potash, yields a red precipitate, which, when washed out of contact with the air, turns to a chesnut brown, and gradually to a bluish green. This change goes on rapidly in the air, and the precipitate is converted into the basic sulphite of the oxide of chromium.

Phosphate of the Protoxide of Chromium is precipitated from the protochloride of chromium when phosphate of soda is added. The precipitate is abundant, of a blue colour, and quickly turns green in the air.

Carbonate of the Protoxide of Chromium.—The precipitates produced by a carbonated alkali resemble, in many of the relations, the carbonates of magnesia, zinc, and protoxide of iron. When added to boiling solutions of carbonate of potash the protochloride gives a red or reddish precipitate, which, if the boiling is suddenly suspended, assumes, by degrees, in a close vessel, a bluish-green colour, the liquid becoming yellow, and depositing brownish-yellow scaly crystals, which, on being placed on blotting-paper, become opaque and turn green, still retaining their lustre. When placed in water they become yellow, and yield a yellow solution and a greenish-blue residue. If, however, an addition of protochloride of chromium took place after the solution was cooled, a heavy yellow powder separated, and a bluish-green flocculent precipitate, which seemed to originate in the former. The yellow or brownish liquid, when exposed to the air, turns green, and deposits a greenish sediment, which is immediately precipitated by an addition of alcohol. When the liquid is confined in close vessels, carbonic acid escapes, and the first greenish flocculent precipitate is deposited, which gives off carbonic acid and hydrogen, turns brown, and appears to become Peligot's hydrated oxide of the protoxide of chromium.

The author then gives the processes by which he obtained a few other salts, and concludes by describing the reactions of some of the salts of chromium.

Neutral Perchloride of Chromium, $Cr_2\ Cl_2$, appears to suffer no change at first on the addition of fluoride of potassium, but shortly becomes turbid, and afterwards furnishes a green precipitate; with borax and neutral borate of potash this salt gives a bluish-green, with phosphate of soda a green, with carbonate of soda a bluish-green, and with sulphuret of ammonia a green precipitate.

Basic Perchloride of Chromium, $2Cr_2\ Cl_3 + Cr_2\ O_3$, furnishes, with fluoride of potassium, borax, neutral borate and phosphate of potash, sulphuret of ammonia, and carbonate of soda, the same precipitates as the preceding salt. With iodide of potassium it gives a yellow, and with tartar emetic a light green, with benzoate of potash a bluish-grey, and with sulphate of potash a bluish-green precipitate.

Chrome Alum furnishes, with phosphate of soda, a dirty violet, with carbonate of soda light bluish-grey, with benzoate of potash a greyish-blue crystalline precipitate.

The protochloride of chromium furnishes, with fluoride of potassium, a light green precipitate, with bromide of potassium a dark green solution; it has no reaction with iodide of potassium; with sulphite of potash the precipitate is of a brick-red colour, becoming brown in the course of a few days; with borax and neutral borate of soda pale blue precipitates; with phosphate of soda a bright blue precipitate; with carbonate of soda a yellowish-green precipitate (the liquid also becomes yellow); with oxalate of potash a greyish-green precipitate; with acetate of soda a red liquid, depositing red crystals; and with sulphuret of ammonium a black precipitate.—*Journ. für Prakt. Chem.*

ON A NEW ALKALOID (PSEUDO-QUININE).

By M. MENGARDUQUE.

M. Pelouze had in his laboratory an extract of quinine of uncertain origin, and entrusted me with its examination as an analytical exercise. It presented a substance of a red, deep brown colour, was friable, very bitter, little soluble in water, soluble in acids, which it saturated in the manner of alkaloids so as to form real saline solutions, from which it was again precipitated by water as a ponderous substance.

This substance, when treated according to the processes for the extract of quinine and cinchonine, did not show the least trace either of one or the other of these alkaloids, nor did I find in it the cinchonatine of M. Manzini; but I was fortunate enough to discover therein an alkaloid which I considered to be new, and which I was able to define in a manner as to leave no doubt about it upon the mind of M. Pelouze, who had the kindness to watch my experiments.

This alkaloid differs from the substances which accompany it in the extract by its greater capability of saturating acids, which it does to such a point that it drives off the ammonia of these combinations, just as lime or baryta are known to do; it also differs by its difficult dissolution in even boiling ether,—circumstances which I turned to good account when preparing it.

I boiled the extract with its own weight of hydrochlorate of ammonia until no more ammoniacal gas escaped. When cold it deposited a brown and very abundant mass of the consistency of syrup, and there was floating above it a limpid liquid of a light amber colour, which, when decanted and filtered, was at once precipitated by ammonia.

The product thus obtained was yellow and flaky, capable of being softened and becoming sticky by the application of heat. I dried it and treated it with cold ether, which dissolved the greatest part of it, leaving as residuum a white powder-like substance, which is the new alkaloid in a state of purity.

This product, so purified, presents the following characteristics:—On being exposed to the action of heat on a lamina of platinum it melts, and afterwards burns with a blue flame without leaving any residuum; it is soluble in water, insipid, soluble in alcohol, much more in warm alcohol than in cold; even an alcoholic solution of it crystallizes with facility in irregular prisms; it is soluble in the mineral and organic acids, even when diluted; it is insoluble in ether. Ammonia, potassa, soda precipitate it in its saline solutions; water separates it from its solution in alcohol. Finally, if dissolved in chlorine water, and a few drops of ammonia be added, the liquor assumes a yellow-reddish colour. We know that quinine under similar circumstances gives a green solution.

Its solution in sulphuric acid does not tinge litmus paper; it is a little bitter; when evaporated it gives beautiful crystals of prismatic form.

A solution in hydrochloric acid presented all the characteristics of a hydrochlorate, but refused to crystallize.

An analysis of its elements has given:—

	I.	II.
Carbon	76.5	76.7
Hydrogen	8.1	8.2
Azote	10.2	10.4
Oxygen	5.2	4.7
	100.0	100.0

If I am not mistaken, the chemical and physical properties of this substance, and especially its elementary composition, are such as to pronounce it a new alkaloid.—*Journal de Pharmacie et de Chemie, par M. Charles Gerhardt* (Nov., 1848).

FOREIGN SCIENTIFIC INTELLIGENCE.

BERLIN ACADEMY OF SCIENCES.

ON THE EMPLOYMENT OF SAL AMMONIAC IN CHEMISTRY. BY PROFESSOR ROSE.

It is now some time since M. Rose sought to demonstrate that the chloride of ammonium was an excellent means for completely disengaging by volatilization many of the metals, and principally arsenic, antimony, tin, and their combinations, after which might be determined the bases, and particularly the alkalis, with which the acids of these metals were united, under the form of metallic chlorides, with the greatest precision. At the same time M Rose also remarked that the employment of sal ammoniac was not limited in analytical quantitative researches by the dry way to the combinations of the metals named, and that, indeed, the chloride of ammonium might be employed in the examination of the salts of the metallic acids, even those of which the metals are not driven off in a volatile form by chloride of ammonium; he also remarked that there were a considerable number of the combinations of metals with sulphur, such as arsenic, antimony, tellurium, and tin, which were decomposed by the chloride.

Titanates.—If titanic acid be heated with sal ammoniac, the latter volatilizes, whilst the acid loses none of its weight. Titanic acid forms with the alkalis only insoluble acid salts: these salts are soluble in hydrochloric acid, but become absolutely insoluble when they have lost by calcination their water of hydratation. It is, therefore, very difficult to determine their composition, when at the same time we would not calculate as loss this water of hydratation.

The thing becomes easy of accomplishment when we submit them to the treatment of sal ammoniac. The proportion of water is first ascertained by calcination, the calcined mass is mixed with sal ammoniac, the mixture is then calcined, and the operation repeated until there is no longer any loss of weight. Whilst the titanic acid undergoes by this treatment no change whatever, the alkali has abandoned its oxygen and replaced it by chlorine. We can thus, simply by the increase of weight, calculate the entire composition of the anhydrous salt; for the difference of the atomic weight of the oxygen and the chlorine is to that of the chlorine as the excess of the weight is to the quantity of chlorine in the mass treated by the sal ammoniac: by means of this quality of chlorie we find that of the alkaline metal and of the titanic acid.

A simple method of controlling this analysis consists in treating the mass calcined with sal ammoniac by water, which dissolves the alkaline metallic chloride, the proportion of which can be obtained by evaporation; whilst the titanic acids remains insoluble. The result of these researches is that the potash salt, dried at 212°

Fahrenheit, is composed after the formula $\dot{K}\dot{T}i_6 + 3H$, and the soda salt by that of $\dot{N}a\dot{T}i_6 + 5H$.

The first is in the form of a powder, which appears crystalline under the microscope; the second is not crystallized, but has the appearance of vitreous fragments.

Sulphates.—The alkaline sulphates are completely transformed when heated with sal ammoniac into alkaline metallic chlorides, the weight of which gives exactly the proportion of the sulphate. The sulphate of baryta is now decomposed with the aid of heat by the chloride of ammonium, but it is almost impossible to obtain a complete decomposition, because the fused chloride of barium which results preserves the portion of sulphate of baryta hitherto untouched against all decomposition. The sulphate of magnesia is not decomposed by the sal ammoniac.

Seleniates.—The seleniate of baryta when heated with sal ammoniac is transformed into a mixture of selenite of baryta and chloride of barium, which, when rid of the selenium, appears brown.

Compounds of Alumina.—Alumina in fine powder volatilizes for the most part when heated with sal ammoniac. A small portion which appears to be of a coarser quality obstinately resists the action of chloride of ammonium. Alumina after a long calcination acquires the property of being no longer acted upon by chloride of ammonium. The sulphate of alumina heated with chloride of ammonium volatilizes without leaving any residuum. Potash alum is also completely decomposed, but the residuum is not a pure chloride of potassium, but a double compound of chloride of aluminum and chloride of potassium, of little volatility.

Glucina.—The combinations of this earth comport themselves with sal ammoniac exactly in the same manner as the compounds of alumina. The light carbonate of glucina is more readily decomposed by the chloride of ammonium; nevertheless the first cannot be completely volatilized by new treatments with chloride of ammonium. The more this earth is calcined, the more it resists the action of the sal ammoniac.

Oxide of Iron.—When the oxide is heated with sal ammoniae the mixture fuses, and readily rises over the edges of the crucible. Mueh iron is volatilized under the form of chloride in red vapours, and there is deposited in the interior of the crucible on its sides oxide of iron in a crystalline state, resulting from the oxidation of the chloride.

Oxide of Manganese.—This oxide, when acted upon by chloride of ammonium, is transformed into chloride of manganese, in the midst of which is formed by oxidation a small quantity of oxidulous oxide of manganese.

Oxides of Nickel and Cobalt.—These are transformed when heated with chloride of ammonium into a regulus of the metal. The arsenical nickel (nickelsprism) is but partially decomposed, the arsenic volatilizes, and the nickel remains under the form of chloride.

Oxide of Bismuth is reduced with sharp detonation to metallic bismuth.

Compounds of Silver.—The chloride of silver mixed with chloride of ammonium and heated undergoes no change. The oxide of silver heated with sal ammoniac leaves at the same time metallic silver and chloride of silver. At the first contact of the heat one part of the oxide is reduced to metallic silver, which, heated with the sal ammoniac, undergoes no change. The portion of the acid which is not reduced by the heat when the chloride of ammonium begins to react is changed into chloride of silver. The antimoniuret is decomposed, but in an incomplete manner, by sal ammoniac. On renewing the action several times there remains at last metallic silver, for the greater the number of times it is heated with the sal ammoniac the more the antimoniuret of silver loses its weight, and the residue becomes less brittle.

[*To be continued.*]

REVIEWS.

BOWMAN'S PRACTICAL CHEMISTRY.*

There was a time, and that not many years ago, when the kind of publication termed a chemical manual was merely a meagre abstract of commonplaces from larger works, totally devoid of anything like good practical information. The numerous additions to our chemical literature which have appeared of late have all tended towards the direction of practice. They have not been written for the drawing-room, but for the laboratory. Hence the success with which their ministrations have been attended. Mr. Bowman's little treatise is a compromise between the purely systematic and purely experimental, and thus serves to fill a void in chemical literature which has been often recognised. The learner, when he first commences the study of a new science, does not require to be burdened with the task of referring to a multiplicity of books. A treatise which should be sufficient in its practical detail to initiate the pupil to laboratory operations, and at the same time explain the rationale of the phenomena seen, was a desideratum. This Mr. Bowman's manual supplies.

Many of our readers have from time to time requested us to furnish them with information relative to the use of chemical symbols. This, on some occasions, we have done. Much more, however, may be profitably said on this important subject so necessary to the comprehension and study of modern chemistry. Mr. Bowman's exposition of the use of symbols is clear, definite, yet concise. He has also ventured to introduce an extension of the symbolical meaning by varying the type of his symbolical letters. This is a plan which many will admire, and we should be amongst the number could we be certain that mistakes in printing would not be made. After having given a copious list of symbols, our author opens his subject thus:—

"Each of these symbols expresses one equivalent or atom of the substance which it represents. Thus H stands for one atom or equivalent of hydrogen; Cu for an equivalent of eopper; *Hg* for one of mercury.

"When a small figure is placed to the right of a symbol, rather below the line, it means that there is that number of equivalents of the substance present. Thus Pb_2 means two equivalents of lead; O_5, five equivalents of oxygen; H_{10}, ten equivalents of hydrogen.

"Two or more symbols placed together signify that the elements which they represent are chemically united in the closest manner. Thus *HO* stands for water, which is a compound of one equivalent of hydrogen and one of oxygen; SO_3 represents anhydrous sulphuric acid, composed of one equivalent of sulphur and three of oxygen; $C_{12}H_{10}O_{10}$ represents starch, which consists of twelve equivalents of carbon, ten of hydrogen, and ten of oxygen, chemically combined together.

"When symbols are separated by a comma they represent compounds which are held together by a force less strong than that which unites elements that have no such mark interposed. Thus KO,SO_3, means sulphate of potash, composed of potash and sulphuric acid. The constituents of sulphate of potash, therefore, are both compounds, and the affinity which unites the potassium with the oxygen, and the sulphur with the three equivalents of the same element, is supposed to be stronger than that which unites the acid with the base, since it is easier to break it up into potash and sulphuric acid than into potassium, oxygen, and sulphur.

"When the sign + is interposed it indicates that the substances between which it is placed are united in a manner still less intimate. Thus in erystallized carbonate of soda (NaO,CO_2 + 10 Aq), we have sodium and oxygen in the soda, and carbon and oxygen in the carbonie acid, combined in the closest and strongest manner; the soda and carbonic acid thus formed are separated by a comma, showing that they are held together by what we may here call the second degree of affinity; while the ten equivalents of water of crystallization, separated by the sign +, are held by a much weaker force, so feeble, indeed, that a very moderate heat is sufficient to expel them.

"The sign + is used also to separate the symbols of substances which are entirely disunited, as when we wish to express a mixture of carbonate of lime and hydrochloric acid, we put it thus, $CaO,CO_2 + HCl$.

"A large figure placed immediately before a symbol multiplies all the symbols as far as the next comma or + sign. Thus, in the common phosphate of soda ($2NaO,HO,PO_5$) there are two equivalents of soda, one of water, and one of phosphoric acid, combined together. If a large figure were placed before the whole formula enclosed in brackets, thus, 5 ($2NaO,HO,PO_5$), it would represent five equivalents of the entire salt.

"It is really wonderful how much these little symbols are capable of expressing, and how often and completely they assist in simplifying and rendering intelligible even the most complicated chemical changes; for, besides the information they convey relative to the composition of the substances which they express, they can be so combined in the form of equations as to show in the most perfect manner the various compounds which result during chemical decompositions. For this purpose the symbols of the substances employed are placed together, so as to form one side of the equation; on the other side are placed those of the substances which are produced during the decomposition; and, as no atom of matter is lost during these transformations, it necessarily follows that the value of both sides of the equation must be equal. For example, the decomposition of carbonate of lime by hydrochloric acid may be thus represented:—

$$CaO,CO_2 + HCl = CaCl + HO + CO_2.$$

"Here we place the symbols of carbonate of lime and hydrochloric acid on one side, and on the other those of chloride of ealcium, water, and carbonic acid, which are produced during the decomposition; and it will be observed that on each side there are exactly the same number of equivalents, namely, one of ealcium, three of oxygen, one of carbon, one of hydrogen, and one of chlorine.

"I have ventured to introduce a slight modification of the usual mode of printing the symbols, which will enable the student to see at a glance whether the substances expressed are in the solid, liquid, or gaseous form.

"Those in the solid state are printed in strong Roman type, as Pb, lead. Liquids, or substances in solution, are printed in strong italics, as *HO*, water; and gases or vapours are represented by thin letters as H, hydrogen, HO, steam.

"Thus, in the above equation, liquid hydrochlorie acid (*HCl*) is poured on solid carbonate of lime (CaO,CO_2); chloride of ealcium (*CaCl*) is formed, which remains in solution, together with carbonic acid (CO_2), which passes off in the gaseous form.

"It is very important that the student should at once begin to make careful notes of all the experiments he engages in. He should endeavour to do this in as concise and methodical a manner as possible, and he will find it very advantageous to make use of symbols in describing the substanees he employs, and the changes which they undergo: he will thus be able to record mueh in a small space, and at the same time he will be making himself familiar with the composition of the substances with which he is experimenting.

"When, as is often the ease, especially in analytical experiments, there are several solutions and precipitates either filtering, digesting, or waiting till the operator has leisure to attend to them, it is neeessary to mark them in some way, to prevent confusion. This is easily done with small pieces of gummed paper, on which a letter

* An Introduction to Practical Chemistry, including Analysis. By John E. Bowman, Demonstrator of Chemistry in King's College, London.

or number may be written, corresponding with a similar reference mark in the note-book.

"The student will soon learn by experience that he cannot be too methodical in his operations, or too careful in cultivating habits of neatness and cleanliness. The presence of a little saline or other impurity in a glass, owing to careless washing or a little extraneous matter having been allowed to find its way into a bottle or test-tube, may retard or spoil the result of whole days of labour."

With respect to the most important subject of cleaning and cleanliness, we are glad of the opportunity to prove to our young readers that the strict,—we had almost said *stern*,—injunctions on that head propounded by ourselves are repeated quite as emphatically, although in other words, by our author :—

"It is easy to clean even the dirtiest vessel, provided it has not been allowed to remain long with the impurities adhering to it ; this, indeed, should never be permitted, and is readily avoided by making it a rule never to leave work for the day until the whole of the soiled apparatus has been thoroughly washed, and left to drain during the night, ready for wiping the next morning. For most purposes of cleaning water will be found sufficient, especially when the dirt is still moist; and, when mere rinsing does not remove it, gentle friction with moist tow and coal ashes will, in most cases, prove effectual. When the form of the vessel to be cleaned is such as will not allow the introduction of the hand (as flasks, test-tubes, &c.), a piece of stick or wire, having a little tow wrapped round the end, will be found very convenient. Glasses or basins that have been set aside to drain should, before using, be wiped with a dry clean cloth, to remove any adhering particles of dust or moisture. Bottles or flasks, when required to be perfectly dry inside, may, after most of the water has been removed, be easily dried by warming them gently, and blowing air into them through a glass tube, either with the bellows or from the lungs; in this way the water is converted into vapour, which is quickly removed by the current of comparatively dry air.

"When a glass or dish is greasy, it should be first wiped as clean as possible with tow or a dry cloth, then moistened with a little strong potash, and, lastly, well washed and rinsed with water. When the dirt to be removed is resinous also, or tarry, the application of strong potash or sulphuric acid will generally act upon it in such a way, that subsequent washing with water, together with gentle friction with coal ashes, will render it quite clean. It often happens, especially when a glass has been allowed to dry in a dirty state, that an insoluble crust is formed on the surface, which is very difficult of removal by mechanical means, but readily yields on the application of a few drops of hydrochloric or some other acid. An instance of this is afforded by solutions of lime, which, on exposure to the air, frequently deposit a crystalline sediment of carbonate of lime, which adheres strongly to the glass, but instantly dissolves on the addition of the acid.

"When thrown upon his own resources, the student will often find it of the utmost value to be able to substitute, in default of more perfect apparatus, the common things used in domestic life, which are to be found in every house, such as glasses, plates, cups, saucepans, &c. When in addition to these he has at his command a blowpipe, a small piece of platinum foil and wire, a flask or two, a funnel, and a little glass tubing of different sizes, he will, with the exercise of a little ingenuity and contrivance, be able to go through a very considerable course of experimental chemistry. He may rest assured that it is no disadvantage, but rather the contrary, to be thus compelled to devise and construct for himself rude and extemporaneous forms of apparatus ; and, if he should require encouragement to persevere in spite of the scantiness of his resources, he need only be reminded that the majority of those whose names shine brightest in the annals of science have laid the groundwork of their future eminence while placed under the most unfavourable circumstances. So it was with the great Davy ; so with Dalton, with Scheele, Faraday, Dumas, Liebig, and many others almost equally illustrious."

THE PLANTAGENET RAZOR.

Mr. Stewart, the inventor of the Plantagenet razor, sent us one for our opinion. Having tried the instrument, we were very much delighted with its principle of construction, which being strictly mechanical, however, we did not see how it could fall within our sphere of comment. We are enabled, however, to suggest to the inventor a most important chemical principle which he may invoke, the mechanical nature of his razor remaining intact. We must premise our observations on this head by the statement that the plantagenet is peculiar in being supplied with a comb-shaped guard, which prevents the razor blade from cutting, except it be held at the angle most adapted for effecting abrasion of the beard, and from dangerously cutting under any circumstances. The comb-like protector is now made of German silver, and thus, with the steel of the razor blade, a galvanic circle is constituted, of which the latter is not the protected part. If the guard or comb were made of zinc, not only would the razor possess all its present good qualities, but its blade would be protected from rust. Let the manufacturer profit by this suggestion.

THE CHEMICAL TIMES.

SATURDAY, DECEMBER 16, 1848.

OUR OWN SERIES.

No. III.

ON CHEMICAL MANIPULATION.

THE CLEANING OF GLASS—(*Continued*).

WE have now to direct the learner's attention to the methods of cleaning glass vessels of more complex form than any which have hitherto come under our notice.

To this category must be referred bottles, flasks, retorts, bulbed tubes, &c., comprehending a great number of instruments for which there is no name whatever.

First of all we will commence by the cleaning of bottles. These are subject to be soiled by any of the impurities to which other glass vessels are liable, and they present certain conditions of difficulty in this respect, that in many cases, that is to say, whenever the orifice of their mouths is smaller than a certain limit, even indirect friction of a stick covered with cotton or linen cannot be applied to remove any impurities, neither can their internal surface be polished by means of chamois leather. Some other methods, therefore, of attaining the end desired must be devised.

The first thing in this case, as before, is to ascertain the kind of impurity to be removed, and, consequently, the chemical agent best adpated for removing it. Generally speaking, the plan of operation should be as follows :—

A portion of the chemical agent, sufficient to fill one third of the capacity of the bottle, should be poured in, and now should be added some brown paper, pulled into small pieces; also some shot. The whole being well agitated, it will be found that the mechanical agency of the brown paper and the shot will be about equivalent to manual friction, or that accomplished by the introduction of a padded stick. When it is observed that all the particles of adherent dirt have been removed, the chemical liquid may be poured into the next bottle of the series to be cleaned, and so on until its chemical agency has become expended. The bottle should now be rinsed out in many waters, the last being invariably distilled water. The reason of this is obvious, seeing that as the interior of the bottle cannot be wiped dry, but that dryness must result from evaporation, all the impurities which common water always contains would be inevitably left upon the interior surface of the glass.

After these many successive washings just described, the last with distilled water, the bottle may be regarded as clean, and for many purposes it may be applied at once to the intended use, or may be restoppered and put away. There are many purposes, however, to which wet bottles are totally inapplicable, such as the preservation of certain gases, of which ammonia is an example. Hence the efficiently drying a glass bottle is often no less necessary than its efficient cleansing. This is accomplished as follows:—The greater portion of water having been allowed to drain away by simply turning the bottle upside down, and letting it remain for some time in this position, the bottle is warmed before the fire, and, one end of a glass tube being inserted, air is at first blown by the mouth. The effect of this treatment is the expulsion of a large amount of water in the state of vapour; soon, however, there arrives a period when the air of the lungs conveys more moisture than the remaining thin film of water on the interior of the bottle would furnish. Whenever this period has arrived the operation of blowing must give place to that of suction, and for a reason too evident that it should be mentioned. The operation of suction may be known to have been continued sufficiently long when, a clean and dry piece of tube being used, no more moisture deposits on its inside.

It is evident that we have hitherto supposed the operator to be dealing with small-mouthed bottles, for, in point of fact, those with mouths sufficiently large to admit of direct or indirect friction may be cleaned in the simple manner, and may be dried by means of filter-paper, and polished as usual. Flasks, tubulated retorts and bulbs, and a great variety of other glass apparatus, must be cleaned and dried in the manner directed for small-mouthed bottles. The operator, however, will have anticipated the existence of many forms of glass apparatus of which the plain or non-tubular retort is the type, consisting of a bulb or expansion joined to the tube part by an angle or bend. The young operator will be anxious to know how such are to be dried.

In the language of absolute truth, they cannot be dried at all. Dried to all appearance they may be, and useful for the greater number of operations,—but, should there occur in the course of chemical research the necessity for a non-tubular retort absolutely dry, a new one should be selected that has never been used before.

There exists a great number of chemical instruments open at both ends, but made up of

bulbs joined to tubular portions, either straight or bent. Such instruments are exceedingly difficult to clean, if they should happen to be soiled internally by any substance that not only requires chemical but mechanical agency for its removal.

The utmost that can be accomplished in the way of mechanical agency consists in introducing and shaking about a few shot. If bits of paper were thrust in for a similar purpose the chances are that they would never be got out again. Hence it follows that in the course of rigid chemical investigation there are many small pieces of apparatus which, on account of the impossibility of cleaning them by reason of their complex form, cannot be used twice, and must be made as often as they are required.

This making of glass apparatus naturally conducts us to another part of our subject, viz., the cutting, the bending, and blowing of glass.

THE GAS MONOPOLY.

A NOTION seems to have occupied the minds of certain City gas companies that their staple production is referable so exclusively to the realm of the spiritual, the vague, and mysterious, that any reasoning about it is entirely out of the question to men of mere ordinary capacities and common sense. Nothing less than this conviction, we presume, would have led them to try such a hazardous experiment on the gullibility of the gas-burners of Farringdon Without, as we heard detailed on Tuesday night at the public meeting held in Anderton's Hotel. Our readers are well aware that a widely-ramified movement now exists in this city and its suburbs to cheapen the price of gas. Long before the question of thus cheapening it became publicly discussed, we, on many occasions, held forth in our pages, some instances of the great peculations to which the gas-burning community were habitually subjected. Our remarks, nevertheless, were in advance of the time, they fell stillborn upon the public ear, and were lost upon all but those of our own scientific circle. Lately it has been demonstrated by experiments, and on authority which preclude all doubt, that coal-gas of good quality can be remuneratively distributed in London for 3s. 6d. per thousand cubic feet, instead of 7s. now charged. Instead of 7s., we say, the price *was* 8s. And now comes the amusing part of our story. A certain gas company in the metropolis, after much solicitation, many threats, and petitions innumerable, conceded the boon of gas for 7s. per thousand cubic feet. The boon, however, led to this result—at the end of the quarter the greater number of the consumers of gas made by that company discovered that they were actually paying more per measure for gas at 7s. per thousand cubic feet than at 8s.; and this in some cases notwithstanding an actual reduction in the number of burners employed. The general inference from this was obviously as follows, that, although the company had diminished their price per measure, they had consentaneously deteriorated, or, in common language, adulterated, their staple.

Now, this general deduction, comprehended to the extent mentioned even by the exercise of common sense, requires a chemical exposition to reduce it to the simplest form of which it is susceptible. The chemical state of the case is this:—Coal, by exposure to heat in close vessels yields, amongst other volatile matters, certain gaseous combinations of carbon with hydrogen; some of these compounds are much richer in carbon than others, and the amount of illuminating property is in direct ratio to the amount of carbon. Now, olefiant gas, which is the richest of all the gases in the mixture termed coal-gas, consists of four equivalent parts of carbon and four of hydrogen united into the same bulk as hydrogen itself; and by simply heating this gas to a sufficient extent, or, what is almost the same thing, by simply distilling the coal at a high temperature, each volume of olefiant gas is expanded into four, whilst its illuminating effect is diminished four times. Thus a company supplying pure olefiant gas, at 8s. per one thousand cubic feet, might, if volume or the meter test were the mere criterion, expand the olefiant gas four times, charge 2s. per one thousand cubic feet, and still be profited as hitherto.

Thus it is evident that no mere stipulation for a gas company to sell its gas at so much per thousand cubic feet is enough to protect the interests of the consumer; and, inasmuch as the illuminating power of coal-gas is in direct proportion to the amount of carbon which it holds dissolved, this fact should be made to become a prominent element in the contract.

PHARMACEUTICAL SOCIETY.—DEC. 13.

Mr. Morson in the chair.

The first paper read was by Mr. Midgeley, on the preparation of oxide of zinc by combustion.

The oxide of zinc produced by Mr. Midgeley, and forming the subject of this paper, is not prepared by dissolving the zinc in acids, and precipitating and calcining, as directed by the Pharmacopœia, but by the direct combustion of zinc in a current of air.

The author has for several years been preparing it in the following manner:—A muffle was employed made in parts, and heated together after being placed in the furnace. This muffle consisted of a large tile or bottom piece turned up at the edges, about sixteen inches long and ten or eleven wide, to receive the roof or upper part formed by two slanting sides, having a flue at the top perforated with holes underneath, and an opening above whereby a current of air may pass off, thus inducing a current of air through the muffle during the combustion of oxide of zinc.

When the muffle is placed, and red hot, the door being removed, from half a pound to three quarters of a pound of granulated zinc is introduced, which shortly in flames, forming a pulverulent white oxide, which should be gently raised by the point of an even rod to expose the burning zinc to the current; these flakes may be removed when perfectly formed till the whole is oxidized; the muffle should be cleared of one parcel before another is begun. In this way each operation may be finished in half an hour, and the product is a beautiful white oxide, smooth, soft, and light; it, however, requires washing, as it generally happens that a minute portion of metal adheres to the oxide. If it is wanted to save the portion of oxide which would pass off by the current of air, the chimney of the muffle should be continued through the top of the furnace, and pass through a cylinder or tube in which a little water is placed, and by connecting this tube with the chimney of the furnace a draught is secured, and the greatest part of the oxide will be obtained. The oxide of zinc is not volatile, only passes off by its levity in a current of air. These flues should be occasionally cleaned to keep up the current of air, as the success of the operation mainly depends on the draught. Mr. Midgeley had made some of the foregoing remarks public in 1843; and since that time he had been able, principally through the use of larger apparatus and by conducting his operations on a larger scale, to produce before the society a better sample than originally; and also to demonstrate, aided by the reduction in the price of zinc, its applicability to certain purposes for which it was formerly found too costly. The specimen on the table was taken from a bulk of 1½ cwt. prepared by one process. Zinc, or the spelter of commerce, might soon be obtained of extreme purity, and could be made to yield by combustion an oxide free from indications of foreign metallic bodies. Formerly the oxide of zinc thus obtained showed brown spots after washing. The only impunity which could be detected in the oxide of zinc prepared by combustion on Mr. Midgeley's plan arose from the presence of minute portions of imperfectly-oxidated metal, which is removed in sifting, the only process which the oxide of zinc need undergo after it has left the furnace to fit it for immediate employment in ointments, &c. It is not liable to become rancid when made into ointments like the common oxide, and has a superior efficacy for cutaneous disorders and injuries of the skin.

Mr. Redwood had, in a paper published in 1843, remarked that the Pharmacopœia of 1824 had directed the oxide of zinc to be precipitated from a solution of the sulphate. The latter was dissolved in distilled water, and a solution of ammonia added in sufficient quantity to complete the separation of the oxide. When the clear liquid was poured off, the powder was to be repeatedly washed with distilled water and dried in the sandbath. Mr. Redwood found that, of the two substances met with in the shops under the name of oxide of zinc, one was prepared according to this formula of 1824, and the other prepared by substituting an alkaline carbonate for the solution of ammonia in precipitating, the remainder of the process of 1824 being retained. Neither of these resembled the oxide of zinc of the present Pharmacopœia. Mr. Redwood examined a specimen of oxide of zinc of the Pharmacopœia of 1824 formed by precipitating from a solution of sulphate of zinc with solution of ammonia. It presented the appearance of a very white light powder, and afforded no effervescence on the addition of acids, but yielded a dense precipitate on adding chloride of barium to its solution in hydrochloric acid. It was found to contain 64 parts of oxide of zinc, 13 of sulphuric acid, and 23 of water. The correctness of this statement Mr. Midgeley calls in question, and denies that sulphuric acid could exist in a free state with oxide of zinc, which he believes it would saturate, and only remain permanently fixed, taking up water of crystallization. It seems certain that all the preparations of oxide of zinc prepared according to the Pharmacopœia contain only rather more than half the substance they represent; they can, therefore, be of only half its efficacy in practical use. Besides the pharmaceutical uses of oxide of zinc, it is prepared by combustion, capable of supplying the place of white lead as the base of paints. It is free from the noxious properties of the latter, it resists the action of inflammable gases, is not affected by carburets or sulphurets, or the exhalations of animal matter, and cannot be decomposed by other metals. It is positively electric, and therefore peculiarly adapted to iron work; it is capable of resisting sea water; it would, prepared on a larger scale, rival white lead in price as well as in other qualities; and, lastly, is not liable to the objections to which the preparation of white lead must always be open from the baneful influence of the latter upon the health of those engaged in its preparation.

Mr. Squire observed that in his experience he had found that the oxide of zinc had not sufficient body to serve as a substitute for white lead.

He would wish to know if Mr. Midgeley had seen it in use?

Mr. Midgeley had used it and frequently seen it used. It has the quality of showing itself white while in the process of working, enabling the artist to judge the degree of colour before the work is dry. The white of barytes cannot be seen in water, being transparent: the painter is thus enabled to regulate the lights and shades. With respect to body, zinc is to lead as is two to three. From the relative specific gravities of the carbonate of lead and the oxide of zinc the author considers that three coats of the latter should supply the place of two of the former. The oxide is very opaque.

Mr. Redwood said there could be no doubt, after the communication of Mr. Midgeley, that a very serviceable oxide of zinc was obtainable by combustion, and that it would, in purity as well as in every other respect, be equal to that prepared according to the Ph. process, from which it could not be distinguished. Notwithstanding the remarks which had been made, Mr. Redwood was of opinion that the process of the Ph. Lond., if strictly and carefully followed, would yield an excellent preparation; but it, nevertheless, remained a fact that nine tenths, indeed he might say ninety-nine hundredths, of what is used by the pharmaceutists as oxide of zinc has no claim whatever to that designation. Mr. Redwood, in concurring with others to bring this subject forward, had been anxious to call the attention of retail chemists to the fact that what they used as oxide of zinc was not a pure and genuine article. His attention had been called to this subject some time ago; and he obtained many specimens from the shops and found that none of them contained more than sixty-four per cent. of the oxide: the remainder was water and sulphuric or carbonic acid in combination with the oxide. It was important to remind chemists that they should examine oxide of zinc. Mr. Midgeley's preparation is liable to one objection alluded to on a previous occasion, one which will, no doubt, be obviated by a slight modification of the arrangement by which it is prepared. Minute particles of zinc remain in the metallic state. This is the objection which has always been found to exist in oxides prepared by combustion. The old Pharmacopœias continued for a long period to enjoin the preparation of the oxide by combustion. The zinc was placed in a large crucible, which was put into the furnace, but the oxide forms very speedily a coating over the zinc, and prevents it from undergoing complete oxidation. Mr. Redwood thinks this objection might be entirely removed by submitting the preparation to elutriation; every pharmaceutist is justified by the authority of the Pharmacopœias in substituting this form of the oxide for the one hitherto used.

Mr. Scanlan stated that he tried the proposed method fifteen years ago, when it decidedly failed, from the mass of metallic zinc which was left. Perhaps this was owing to the too rapid passage of air through the zinc.

CALAMINE. BY JACOB BELL.

The impurity of the calamine met with in commerce has long been notorious. In July last Mr. Moore procured six specimens of calamine from the most respectable drug-houses in London. Five of these contained no zinc whatever; four of them consisted of carbonate of lime, peroxide of iron, sulphate of baryta, and water; the fifth contains an addition of phosphate of iron; and the sixth contained:—

Silica	28.8
Oxide of zinc	58.6
Carbonate of lime	2.8
Phosphate of iron	6.6
Water	3.2
	100.0

Since then various inquiries have been made with a view to trace the causes of this adulteration, in order to ascertain whether the same adulteration prevailed on the Continent. Mr. Bell thought it advisable to procure specimens from Paris, and six samples were accordingly obtained from the most respectable establishments in that capital: they were found to be fair specimens of calamine, although differing in colour, and not prepared as in this country. The compound sold in England as calamine is not to be considered as a fabricated article, but as a native mineral, existing in the same locality with the proper article, which has been accepted by the trade and the public for a long period, has answered every requirement, and given general satisfaction. The specimens which are on the table are native carbonate of zinc in its usual state; secondly, larger in size; the third, crystalline, with minute particles of fluor spar; the fourth, cupreous calamine; the fifth, stalactitic. Some others consist of calcareous sulphate of barytes and the Dutch lead of commerce; and the false calamine of the shops, the last of the six, is contaminated with a sufficient quantity of iron to give it the colour of calamine, and is a very frequent occurrence in the market. The spurious article is of a brighter and more popular hue than the genuine drug, which is a dirty brown. The true article is rather dearer than the false, but not so much so as to induce and maintain a practice of substitution, were a demand for the genuine article general. The specimens of English calamine examined were obtained from Mr. Adam, of Matlock, who furnished the information desired, and sent me half a ton of real calamine.

Mr. Bell observed that it would scarcely be worth the while of the small consumer to occupy himself with the preparation of calamine, and at the same time would be indiscreet to entrust the process to the hands of parties accustomed to supply the present articles to the trade; but these obstacles to the use of the genuine article would disappear were a sufficient demand to arise for the same in the trade. Mr. Bell stated, in conclusion, that the half ton of pure calamine was to be disposed of to any party who might feel disposed to become a purchaser.

Mr. Midgeley observed that in the calamine district the distinction between the genuine and spurious calamine was distinctly recognised; that no difficulty whatever was experienced in procuring the latter, but that purity was simply a question of price. Mr. Midgeley took occasion some time since, having to prepare a quantity of Turner's cerate, to submit the medicinal efficacy of the two varieties to an experimental test, and was struck by the marked superiority of the cerate prepared with genuine calamine.

Mr. Fordred said that before the inquiries of Mr. Moore had been made public he had submitted several specimens produced from wholesale houses to examination, and had pointed out that they consisted mainly of sulphate of baryta. In the specimens examined the quantity of iron present was not sufficient to give the bright colour, which was artificially communicated by bole.

Mr. Squire thought that the use of calamine in cerate might be altogether dispensed with, and oxide of zinc substituted, to which he believed it owed all the efficacy it was reputed to possess.

Mr. Morson said it struck him as very questionable whether a white Turner's cerate could ever be accepted by the public; its identity would be liable to constant challenge; this, he thought, was an objection of considerable importance, especially in the provinces. He anticipated for a white Turner's cerate most complete repudiation from that important class—the old women!! There was, at present, in the Pharmacopœia an ointment of ox. zinc: it was true this ointment might be coloured to resemble the popular nostrums. Calamine was a drug, which to obtain pure was a matter of difficulty to the chemist, from the number of extraneous substances, to separate which was next to impossible.

Mr. Redwood observed that the adulteration of the article, or its replacement by another, rested in this case, not with the wholesale dealer, but with more remote parties. He had been at some pains to make inquiries, and had found that the wholesale houses all bought of the same person, a dealer in the City, who tells him (Mr. Redwood) that he obtains it from a house at Derby, which has made calamine for many years and supplied the trade. It was with that party the substitution really lay. The best calamine which could be made without zinc was to be had from this man.

Mr. Morson announced the presentation to the society of the portrait of the treasurer, Mr. Pigeon.

A note was then read from Mr. Bartlett, accompanied with specimens of cornudram, a mineral recently found in India and some parts of China, which, from its peculiar hardness, may, it is thought, prove of great service in the laboratory, when made into files and wheels, for cutting glass and other hard substances. It may be used for polishing gems and sharpening steel instruments.

Mr. Redwood presented an improved preparation of collodion, the invention of Mr. Fordred, of Hackney. The expectation which had been formed of this adhesive solution had been disappointed, as it was found that the substance, when dry, was not only non-elastic but also non-contractile. This had led some surgeons, as Mr. Acton, in England, and M. Chapeteau, in France, to resign themselves to the loss of the once-promising accession to the number of surgical appliances, and to substitute such compounds as the solution of gutta percha and caoutchouc in benzole. The author has succeeded in preparing a solution which leaves upon the skin a film which obeys all the expansions of the tissue, and answers all the purposes of the gutta percha mixture, without the smell which attends the employment of that compound. Mr. Fordred deferred the communication of his process until the completion of some researches in which he is now engaged.

CHEMICAL SOCIETY.

[Communicated by R. WARINGTON, Esq.]

November 6.—The president (Wm. Thomas Brande, Esq.) in the chair. The following papers were read:—1. "On Coniine and the Products of its Decomposition," by John Blyth, M.D., Royal Agricultural College, Cirencester. The author, after reviewing the labours of previous investigators of coniine, proceeds to describe the plan adopted for obtaining this principle from the crude aqueous product of distillation. The crude oil, which contained a large quantity of water, is treated with caustic potash, and allowed to stand for some time, when it is redistilled in an atmosphere of hydrogen gas. Another oil appears to accompany it in the first portions of the distillate. The boiling point of coniine was found between 168 and 171° C. (334.4° F. and 339.8°); at a temperature above 175° C. (347° F.) decomposition of the base commences. The properties of coniine were then described at considerable length, and from these it appears to be a very much more powerful base than most metallic oxides, precipitating the oxides of copper, lead, zinc, manganese, and aluminium, from their salts, but exerting no action on the salts of the alkaline earths. Oxide of silver is precipitated from the nitrate by this base, but is as soluble in an excess of the oil as in ammonia. The atomic weight of coniine is estimated by Dr. Blyth as 1664, and its composition expressed by the formula C_{17}, H_{17}, N, which slightly differs from the results of former analysts.

Coniine combines directly with chlorine, bromine, and iodine, giving rise to crystalline compounds.

The salts of coniine are obtained with difficulty in a crystalline form, and, from their tendency to deliquesce, are ill adapted for analysis.

Double salts are formed with chloride of platinum and mercury.

Exposed to the action of the air or oxygen, coniine is first converted into a resinous body, which appears to possess feeble basic properties, and forms the connecting link between coniine and its most common product of decomposition,

viz., butyric acid. The double salt of coniine and biehloride of platinum, treated with an excess of bichloride of platinum, appears to be converted into butyrie acid, and a combination of protochloride of platinum with ehloride of ammonium is formed at the same time, while carbonic acid escapes. Butyric acid is the general product of powerful oxidizing agents upon coniinc. One equivalent of coniine with eight of oxygen affording the elements of two equivalents of butyrie acid, one equivalent of ammonia, and one of carbonic acid.

2. "Observations on the Atomie Volumes and Boiling Points of Analogous Organic Liquids," by W. A. Miller, M.D., Professor of Chemistry, King's College, London. In this country the attention of chemists generally has lately been recalled to the above subject by the appearance of a valuable report by Otto, in the first volume of the Cavendish Society's publications; and M. Pierre having recently published a series of most elaborate researches upon the expansion of a considerable number of liquids, both inorganie and organic, as also their boiling points and sp. gr. 0° C. (32° Fahr.), Dr. Miller was induced to treat the generalization of Kopp by these new data, and, with surprise and disappointment, found the results very wide of those required. The author then gives a detail of these results, with a tabular statement, and closes his eommunication with these remarks:—"Before any general law can be deduced, with even tolerable hopes of suecess, a large number of careful and laborious experiments are indispensably necessary. The industry of chemists is daily in some degree filling up this void, and no one has attempted to remove this difficulty with greater earnestness than Kopp himself; but, until this want is supplied, the foundation on which alone such speculations can be built, on which the still more extended and elaborate calculations of Liebig can be based, is wanting. Numerous remarkable numerical eoincidences in compounds of analogous compositions show that some important quantitative connection between chemical composition and atomic volume exists, but the true law of that connection still remains to be discovered."

3. "Researches on the Amyle Series," by — Medlock, Esq. The author detailed his experiments on the action of phosgene gas upon hydrated oxide of amyle. The gas is absorbed by the oil with great avidity, and hydrochloric acid abundantly evolved, the product of the reaction being chlorocarbonate of oxide of amyle, which, however, is a very unstable compound, and, being necessarily in contaet with water in the operation, is immediately converted by that liquid into carbonate of oxide of amyle, hydrochloric and carbonic acids. If the crude product from this reaction is treated with an alcoholic solution of ammonia, a white substance is obtained resembling spermaeetti, which the author eonceives to be the urethane of the amyle series. The author then describes the preparation of sulphocyanide of amyle from the sulphamylate of lime and sulphocyanide of potassium. The product is a yellow oil of disagreeable odour; when purified it boiled at a temperature of 197° C. (386.6° F.), and analysis indicated its composition to be C_{12}, H_{11}, N_1, S_2. The action of nitric acid upon this compound gave rise to the production of hyposulphamylie acid, the sulphur of the sulphocyanogen being oxidized, and the cyanogen evolved as nitrogen and carbonic acid. The hyposulphamylic aeid is analogous to the hyposulphathylic and hyposulphamethylic acids, lately described by Dr. Muspratt. The author has investigated the barytes and lead salts of this acid, and is engaged in pursuing further researches into the eompounds of the amyle series.

APPOINTMENT OF A CHEMIST TO THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The directors having been authorized, by the general meeting, held on the 19th of July, to take the necessary steps for establishing a chemical department in eonnection with the society, and, in particular, to select a person of scientific attainments, qualified to undertake its superintendence, and to discharge the duties of a consulting and practical chemist, this appointment has recently, and by the unanimous voice of the board of direction, been conferred on Dr. Thomas Anderson, of Edinburgh, the author of numerous scientific memoirs published in the transactions of different learned societies. Though these afford ample evidence of Dr. Anderson's qualifications, the directors considered it due to him, and to the society, fully to state the reasons by which their selection has been influenced. They have, therefore, issued a circular of testimonials from some of the greatest chemists of the age in favour of Dr. Anderson's ehemical acquirements; and well would it be for the interests of institutions in general if vacant offices were always conferred with motives so pure as those whieh have influenced the Highland and Agricultural Society. Dr. Anderson's ehemical talent and assiduity are well known to all kindred minds abroad no less than at home. We congratulate the society on their ehoice.

And now we will not hesitate to express our dissatisfaction at a sliding scale of laboratory prices for analyses, and even answers to letters, which the Highland Society has thought neeessary to disseminate—a scale whieh, we are free to own, reminded us very much of a huxter's eircular. If only in deference to the name of a chemist whom they respeet, the society should not associate his name with a paltry bill of fare like that which has met our view.

The society will not take our remarks ill, seeing that we offer them in a good spirit.

ON THE EMPLOYMENT OF ARSENIC FOR AGRICULTURAL PURPOSES.

Our pages having been so frequently devoted to the important consideration of the effects of the too prevalent use of arsenic for purposes to which other and better agents might be applied, we beg leave to present our readers with the following communication of Mr. Henry William Fuller, lecturer on medical jurisprudence at St. George's Hospital:—

"In these days of alarm respecting cholera, any faets suggesting an occasional and hitherto unsuspected source of gastric irritation cannot fail to prove interesting to the medical praetitioner; and as the circumstances I am about to communicate have an important bearing, not only upon the sanitary condition of our population, but upon the whole question of poisoning by arsenic, I need make no apology for laying them at once before the profession.

"For some months past, in certain parts of Hampshire, partridges have been found dead in the fields, presenting a very remarkable appearance. Instead of lying prostrate on their side, as is usually the case with dead birds, they have been found sitting, with their heads erect and their eyes open, presenting all the semblance of life. This peculiarity, which for some time had attracted eonsiderable attention among sportsmen in the neighbourhood, led to no practical result until about ten days ago, when a covey of ten birds having been found nestled together in this condition, two of the birds, together with the seeds taken from the erops of the remaining eight, were sent up to London for examination. I was requested to undertake the investigation, and the result of my experiments I will now briefly detail.

"I first examined the seeds taken from the erops of the birds, and deteeted, as I anticipated, a large quantity of arsenic. I will not take up your valuable space by detailing the various steps of my analysis. Suffice it to say that, by Reinsch's process, I speedily obtained a very thick incrustation of metallie arsenie; that I then applied the reduction test, and subsequently Marsh's test, and the tests of the ammonio-nitrate of silver and the ammonio-sulphate of copper, each of which gave its characteristic result.

"Having thus ascertained the presence of arsenie in the food of the partridges, I proceeded to examine the birds themselves. They were plump and in good condition, but the œsophagus was in both cases highly inflamed throughout. The intestines were not inflamed, and presented no trace of ulceration, but they were remarkably empty and clean, almost as if they had been washed with water. May this not have been the result of diarrhœa?

"I now, at the suggestion of my friend Mr. Stone, proceeded to ascertain whether the flesh of birds so poisoned might not of itself prove poisonous when eaten, and, with this view, I carefully cut the flesh off the breast and legs of one of the birds, and gave it, together with the liver, to a fine healthy eat. She ate it with avidity; but in about half an hour she began to vomit, and vomited almost incessantly for nearly twelve hours, during the whole of which time she evidently suffered excessive pain. After this nothing would induce her to eat any more partridge. I kept her without food for twenty-four hours, but in vain; she resolutely refused to touch an atom more of the bird. This being the case, I gave her some beef and some milk, which she eagerly swallowed, proving beyond doubt that her instinet, and not her want of appetite, induced her to forego the dainty meal which had just been offered her.

"I now felt satisfied, from my observation of the symptoms indueed in the eat, borne out as they were by many facts we are acquainted with respecting the action of poisons, that the arsenic which the partridges had swallowed had been absorbed in sufficient quantity into the system to render the flesh of the birds poisonous, and to induee poisonous effects in any one partaking of it. However, I was anxious to leave nothing to hypothesis, and, as the cat had so soon rejected by vomiting the greater part of the bird she had eaten, and pertinaciously refused to repeat the experiment by again partaking of the poisoned food, I was obliged to have recourse to chemical analysis, with the view of ascertaining, with certainty, the existence or non-existence of arsenic in the flesh itself. I therefore cut the flesh off one side of the breast of the other partridge, and, after about an hour's boiling, I obtained by Reinsch's process a thin incrustation of metallic arsenic, thus demonstrating beyond question what the previous experiments had left little room for doubting. I was now anxious to ascertain the source of the poison, and a very little inquiry served to satisfy me on this point. I will not stop to go into many details which, though in themselves exceedingly interesting, have no direct bearing upon the question at issue. I will simply mention the leading facts, viz., that in Hampshire, Lincolnshire, and many other parts of the country, the farmers are now in the habit of steeping their wheat in a strong solution of arsenic previous to sowing it, with the view of preventing the ravages of the wire-worm on the seed, and of the smut on the plant when grown; that this process is found to be eminently successful, and is therefore daily becoming more and more generally adopted; that, even now, many hundreds weight of arsenic are yearly sold to agriculturists for this express purpose; that, although the seed is poisonous when sown, its fruit is in no degree affected by the poison; that, wherever this plan has been extensively carried out,* pheasants and partridges have been poisoned by eating the seed, and the partridges have been almost

* "In a review on Mr. Taylor's work on Poisons in the last October volume of the 'British and Foreign Medico-Chirurgical Review,' the reviewer states, that 'in the spring of 1846, a great number of pheasants having been found dead in their preserve, the crops were removed, and sent to us for analysis, and with them some young wheat, about six inches high, which had been grown from poisoned corn, and on which it was suspected that the birds had fed. The earth about the roots of the plants yielded distinct traces of arsenic, but the leaves were perfectly free from it.'"

universally found sitting in the position I have already described ; and, lastly, that the men employed in sowing the poisonous seed not unfrequently present the earlier symptoms which occur in the milder cases of poisoning by arsenic. This last fact I give on the authority of Dr. Heale, who up to the last two or three years practised at Staines, and has repeatedly had men under his care suffering from symptoms due to this cause.

"Now, the facts just enumerated suggest several most important points for consideration. It is notorious that many of the dealers in game are supplied through the agency of poachers and others who have a direct pecuniary interest in supplying them with the largest possible number of birds. It is certain, moreover, that if men of this sort were to find a covey of partridges in a field, dead, but fresh and in a good condition, they would not hesitate to send them, with the remainder of their booty, to the poulterer, who would as certainly, without suspicion, sell them to his eustomers. And, after the experiments above detailed, there can be no reasonable grounds for doubting that these birds, when eaten, would produce disagreeable and injurious—not to say poisonous—effects on those who partake of them. It is obvious, therefore, that in all cases of supposed cholera, or of suspicious bellyache, occurring at this season of the year, we shall do well to make particular inquiry as to whether our patient has recently partaken of pheasants or partridges purchased at a poulterer's ; and it is further manifest that in all cases of poisoning, or suspected poisoning, by arsenie, the fact of the persons having lately eaten of partridges and pheasants must form an important element in the inquiry, and must tend to cast a suspicion on the evidence adduced to prove a criminal intent in the administration of the poison. So that, in a medieo-legal point of view, the question is one of the gravest import.

"Secondly. If it should prove, on further inquiry, that the practice of steeping seed wheat in arsenic is, even indirectly, productive of injurious effects on our population, it may become, in these days of sanitary reform, a matter for the anxious consideration of the Legislature whether they should not adopt some measure to prevent the continuance of such a custom.

"Thirdly. As in the event of a practice, so destructive of game, becoming universal, pheasants and partridges, in their wild state at least, must, at no distant day, become extinct in this country, it is a question whether landlords may not heneeforth be induced to insert a clause in their leases prohibiting the use of arsenic on their farms ; while, on the other hand, it may be a question with those who are already weary of the protracted debates on the game-laws, whether they should not allow them to die a natural death by the gradual but inevitable destruction of the game it is the object of these laws to preserve."

THE CHEAP GAS AND WATER MOVEMENT.

Within the last few days various public meetings have taken place in different parts of the metropolis for the purpose of securing a cheaper supply of gas and water, for both of which the metropolitan publie is greatly overcharged.

On Monday a meeting, attended by a majority of the parliamentary committee to consider the provisions of the proposed measure for the regulation of the price and supply of gas in the City, was held at the Guildhall, Mr. Deputy Peacock, the ehairman of the City Sewers Commission, in the ehair. The remembrancer having brought up the bill, the clauses were discussed *seriatim*, and the whole of them approved of without alteration, nothing being changed except a few words in the preamble. The whole having been gone through, the committee adjourned, after resolving that the report should be brought up and laid before the commissioners of sewers on Tuesday. The determination was general on the part of the committee to go to Parliament without delay. An abundance of evidence was gone into to show that the necessary article, gas, may be furnished to the citizens for even a less sum than that already named.

At a court of the commission of sewers held on Tuesday in the Guildhall, Mr. Deputy Peacock in the chair, the report upon the Gas Bill about to be introduced into Parliament was brought up. It recommended that the bill be adopted. Mr. Alderman Lawrence opposed the project of turning the corporation into large gas manufacturers, and insisted that monopoly might be prevented by admitting other companies. Mr. Kemp denied that that would supply any permanent security against imposition. Mr. Stacy said the court did not contemplate the manufacture of gas by the corporation, but, armed with the powers which the bill would give them, they would be possessed of the means of checking all gas monopolies. Mr. Harrison considered that all that was wanted was the power to purchase the pipes and mains ; he moved an amendment, which Mr. Dixon seconded, excluding the power to purchase gasworks or erect works. The remembrancer, being appealed to, expressed an opinion that Parliament would not sanction a bill of so limited a nature, upon the ground of the injustice of thus dealing with a company established at a great expense. After much discussion, in which the example of Manchester and Liverpool was cited in support of the application recommended by the report, the amendment was negatived by ten voices against seven, and the report was received. The bill will be prepared and submitted to Parliament without being referred to the Court of Common Council. Before the eommissioners adjourned, Mr. Simon, the City offieer of health, reported that the epidemie was rather on the decline for the last week, and that he had heard of no case of cholera in the City.

On Tuesday there was also a meeting convened to at Anderton's Hotel, for the purpose of breaking down the gas monopoly. During the eourse of this meeting it transpired that although one of the gas companies had dropped the price payable to eonsumers one shilling less, still the quality of the gas had not been so good as heretofore, and hence so much larger an amount was necessary that the quarterly gas-rates were higher than ever.

A numerously attended precinct meeting of the inhabitants of the ward of Bishopsgate-without was held on Tuesday at the ward school-rooms, for the purpose of selecting the eommon counellmen and ward officers for the ensuing year, Mr. Heath, the churchwarden, in the chair. Mr. Heeps observed that he wished to call the attention of the members of the common council to the subject of the high rates of water. A movement against this monopoly, he was glad to find, had been originated, in eommon with that connected with the gas question. He hoped the whole matter would be fully investigated by the members of the corporation, as he believed firmly that the charges of the New River Company were most exorbitant. He observed that some time since he was called upon by the collector of the water-rates, and he was surprised to find that he was charged 50 per cent. in addition to the usual charge, for a service of 16 feet above the level of the street. This he eonsidered to be an imposition, but at the same time he was informed that it was useless for him to appeal to the company.—Mr. Carr said he hoped that both the monopoly in gas and that in water would fall together.—Mr. Percy observed that he was glad that the subject had been brought forward, and he hoped it would be fully taken up at the various ward meetings throughout the city on St. Thomas's-day. He was quite sure, from inquiries he had made, that a good supply of water might be furnished at 10s. per annum ; and he rejoiced that a committee had been formed at the west-end to secure such an object.—Deputy Peacock said that the water question had been noticed by the corporation, and no doubt it would be taken up very largely.—Messrs. Deputy Peacock, C. Gilpin, R. Carr, Pilcher, Hopgood, and Johnson (the present representatives of the ward), were then reappointed for election at the next wardmote ; after which thanks were voted to the warden for his conduct in the chair, and the meeting separated.

THE PRODUCTION OF SUGAR IN THE WEST INDIES.*

[To the Editor of the Times.]

Sir,—The powerful advocacy which the West Indian interests has received at your hands, founded on the strict justice of their claims, and the important effects which the well-being of her colonies must produce on the mother country, induces me to think that the following remarks may not be deemed unworthy of insertion in your columns, as they relate to a subject which must greatly influence the future prosperity of the West Indies. The subject to which I wish to draw attention is the enormous loss, and consequent excessive cost of production, in the staple manufacture of the West Indies, owing to the imperfect, rude, and antiquated mode in which that manufacture is carried on ; and though the facts I have to state are well known to scientifie men, I have recently learned that they are most imperfectly comprehended, in all their startling reality, by the great majority of those who are intcrested in West Indian property. I think, therefore, that a popular statement of the enormous loss which occurs by the present processes used in the manufacture of sugar may possibly draw more attention to this important subject, even though it fail of producing a remedy.

The sugar-cane, when ripe, contains 90 per cent. of fluid matter, which constitutes the cane-juice ; and this juice has been ascertained, by the most experienced chemists, to contain very nearly 21 per cent. of erystallizable sugar, the remainder of the fluid being water and a small quantity of extraneous salts. But it would scarcely be believed that this proportion, namely, 21 per cent. of the weight of the juice, or 19 per cent. of the weight of the eanes, is so reduced by the imperfect process at present used, that the amount of sugar which aetually reaehes this eountry (exelusive of the molasses) is only 7 per cent. of the weight of the juice, or 3½ per cent. only of the actual weight of the canes which pass through the mill. Nor does this constitute the whole amount of loss ; for, owing to the imperfect and destructive process of manufacture, the article produced is so deteriorated in quality that the price obtained for it is far less than would be the case under other eircumstances. The whole art of the sugar-refiner in Europe consists in restoring the sugar to its original purity ; and the loss and expense of this process must be considered as part of the price paid by the sugar-producer for his want of knowledge or careless indifference, in not availing himself of those improvements in manufacture which are quite within his reach.

It will here be perceived, then, that the average actual amount of crystallizable sugar produeed is less than one fifth of what is actually obtainable from the sugar-cane, and that, too, of a very inferior quality. True it is, that no practicable means, applicable on a large scale, are at present known by which the whole of this loss ean be prevented ; and it is equally true that enormous sums of money have been thrown away in futile attempts to carry out the inventions of hosts of experimentalists, who have neither been few in number nor lacking in industry to extract the money out of the pockets of their patrons, even if they have failed in extracting sugar from their canes. But the failure of these plans by no means proves the impossibility of obtaining different results. Satisfactory reasons can be shown for their failure ; and a very moderate share of mechanical and scientific knowledge would have sufficed to show the impossibility of success from many of these very costly experiments. The difficulty of carrying

* We purpose to comment on this letter next week.

out new and complicated inventions, in a distant part of the world, deprived of all those facilities which we possess here, is not duly estimated by the projectors of new schemes; and the difficulty of obtaining the requisite skilled labour for the successful introduction of new processes is an obstacle of no mean importance. But, without waiting for the discovery of new inventions, or trusting too much to the soundness of the novelties proposed by inventors, and their generous devotion in carrying them out at other people's expense, it is certain that we possess the knowledge of established and well-known processes, by which an enormous increase in the yield of sugar must be obtained, and which, known and tried as they are in this and other countries, only require the energy and the capital necessary to overcome the difficulties of introducing them into a country devoid of all facilities, and opposed to them by ignorance of their value and the prejudices of a century's duration.

It would be an invidious task to point out the futile schemes which have been tried or proposed for improving the staple manufacture of the West Indies. Everything, from a plough for the land or a filter for the juice, down to the exportation of concentrated cane liquor and the establishment of central factories, has been advocated, if not attempted. But precisely those plans which are the most practicable of all appear to have received the smallest degree of attention. Experience shows that the principal sources of loss are, first, in the crushing-mill, and, secondly, in the boiling-pans. By the operation of the present mills only 50 per cent. of juice instead of 90 per cent. is obtained from the canes; and, by the present plan of boiling, the sugar is burnt in the pan, and is both wasted in quantity and injured in quality. Plans to supersede the sugar-mill altogether have been tried, but without the slightest probability of success. It is certain, however, that by using the best constructed mills of sufficient power, and by somewhat more care in the mode of working them, 70 per cent. out of the 90 per cent. of juice which the canes contain can be extracted, instead of the 50 per cent. now obtained. Again, by using the vacuum-pan instead of the common open boiler heated by the naked fire, a large increase in the yield may be obtained, and a still greater advantage in the improved quality of the sugar. The original cane-juice is colourless, and it is the mere burning in the pan which produces the dark colour of the sugar, and which colour has to be discharged by the refiner in this country by an expensive and operose manipulation. There is nothing whatever to prevent the sugar being at once made into refined, or lump, sugar in the West India boiling-houses; or, without carrying the process so far as this, such a colourless sugar could be produced as would not only procure a much higher price, but a large increase in the quantity would also be obtained. And, after making the utmost allowance for waste and the necessary imperfection of manufacture on a large scale, it is not too much to say that at least double the present produce could be obtained without the slightest difficulty.

The use of the vacuum-pan, well known and valued as it is in this country, cannot be introduced into the West Indies with success, except on a large scale, and by a combination of interests. Independent of costliness in the first instance, the great expense of procuring the necessary skilled labour for its erection, and subsequently for working it, is only to be overcome by its employment on a sufficient scale to make those expenses bear more lightly. West India proprietors have hitherto done no good in their individual attempts to introduce new processes. One after another they are made to suffer for the ignorance or the cupidity of successive inventors. They are, of themselves, unable to decide upon the probability of success of the new invention; but it might be worth while to consider whether, by uniting their efforts to investigate jointly, and aided by the practical knowledge of scientific and unprejudiced men, the merits of new inventions, or the practicability of introducing those which have been elsewhere found to answer, a benefit might not be speedily produced which their own isolated and separate exertions could never accomplish.

The facts here stated respecting the enormous loss that at present occurs, and which so seriously affect the cost of producing sugar, must sooner or later force themselves, with sufficient vividness, on the public mind to compel the adoption of measures which will place the manufacture of sugar on a more scientific foundation, by which alone, it appears to me, it can become beneficial to our colonies, and profitable to the individual producers.

I am, sir, your most obedient servant,
London, Dec. 9. C. H.

THE CHOLERA.

The following are the fatal cases of cholera registered in the week ending Saturday, December 9:—Three were cases in which inquests were held; the remainder are all certified by medical attendants.

CHELSEA; North-west sub-district.—A man, aged 21 years, and a woman, aged 36 years, died "from the mortal effects of want and destitution," according to the verdict of a coroner's jury. Mr. Larner, the registrar, states that "the deaths occurred in Chelsea workhouse. The deceased persons had made application on Saturday evening for a night's lodging, which was granted. They complained of illness on Sunday morning, when they were immediately admitted into the sick wards, and promptly attended by the medical officer of the establishment, who found them both labouring under strong attacks of malignant cholera. According to his evidence at the inquest both man and woman belonged to the class called tramps. They died—the former on Sunday, the latter on the day following."

ST. GILES; South.—M. 23, "cholera (24 hours)."

STRAND; St. Clement Danes.—M. 58, "epidemic cholera (2 days)." St. Ann, Soho.—M. 1, "cholera Asiatica (10 hours)."

ST. LUKE; Finsbury.—At 50, Old-street, widow of a porter, 51, "bilious cholera."

SHOREDITCH; Haggerstone West.—M. 37, "cholera Asiatica (13 hours)."

BETHNAL-GREEN; the Green.—F. 60, "cholera (12 days)."

WHITECHAPEL; Spitalfields.—F. 32, "epidemic cholera (16 hours)." Whitechapel Church.—In London Hospital, M. 19, "Asiatic cholera (14 hours)" (p.m.); in same hospital, F. 20, "Asiatic cholera (10 hours)." Goodman's-fields.—At 7, Gower's-place, Gower's-row, a labourer, 55, "Asiatic cholera (34 hours)."

ST. GEORGE-IN-THE-EAST; St. John.—At 2, Lower Well-alley, daughter of a biscuit-baker, 9, "natural death, sudden, from cholera (26 hours)."—Inquest.

STEPNEY; Mile-end Old Town, Lower.—F. 8, "Asiatic cholera (20 hours)."

POPLAR; Bow.—At Dye-house-lane, Old Ford, Bow, F. 2, "spasmodic cholera (5 days)." Another case of cholera, not yet registered, has occurred in Dyer's-lane, Bromley, during last week, on which an inquest has been held. The verdict was "Natural death from spasmodic cholera (14 hours)."

ST. OLAVE; St. Olave.—At 2, Magdalen-court, on December 3, son of a musician, 4, "cholera (12 hours); reaction did not take place."

BERMONDSEY; Leather-market.—M. 11, "cholera (47 hours), supposed to have been induced by eating bad fruit."

LAMBETH; Lambeth Church (second part).—At 97, Park-street, shoemaker, 35, "cholera (48 hours)." At 2, Francis-street, son of a bricklayer, 2, "cholera (3 days), convulsions."

CAMBERWELL; Camberwell.—In Camberwell Workhouse, M. 61, formerly a leather-seller, "English cholera (10 days)."

WANDSWORTH AND CLAPHAM; Battersea.—At Sleaford-street, wife of a labourer, 50, "cholera (6 days); consecutive fever, terminating in coma."

In addition to the above may be mentioned a death from Asiatic cholera, after 16 hours' illness, which occurred in the week ending December 2, and is stated by Mr. Baddeley, the registrar of Mile-end Old Town (Upper), to be the first amongst adults which has occurred in his large district. The deceased was a gentleman aged 56 years, who lived at No. 6, Redman's-row. The street is wide and airy, and may be considered healthy. The case is not yet officially returned, as it became the subject of inquest, and the entry has not been signed by the coroner.

Also Mr. Watts, the registrar of the West District of Islington, states that a death from malignant cholera (not yet registered, for the same reason as above) occurred on the 3d inst. at Islington Workhouse after an illness of 16 hours. An inquest was held on the 6th. The deceased, a woman aged 23, was, while under the attack, brought in a cab from a house of ill repute in the east district, and received into the workhouse, where she died soon afterwards. Although the workhouse affords accommodation for 400 persons, it is at the present time so crowded that it is necessary to find room in many private houses for fresh applicants. It is, however, free from sickness. Five inspectors of nuisances were elected last week for the whole parish of Islington, who have already entered on their duties.

The mean temperature of the week was 49 deg., being nearly 9 deg. higher than that of the week ending November 11. The thermometer was as high as 63 deg. 2 min. in the sun on the 9th of December, and as low as 29 deg. 5 min. on the grass on the 3d; the mean temperature of the 8th was 15 deg. 7 min. above the mean temperature on an average of seven years.

RECENT CHEMICAL PATENT.

Alexander Parkes, of Birmingham, experimental chemist, for improvements in the manufacture of metals, and in coating metals. Patent dated April 27, 1848. Enrolled October 27, 1848.

This patent is for the separation of copper and certain other metals from their sulphuretted ores into the state known as regulus or coarse metal; also for the coating of iron and steel. In order to obtain a regulus of copper from a sulphuretted ore, he first forms a fusible slag by the due admixture of the ores themselves with other matters, which act as fluxes, according to the usual practice. To every ton of ore so mixed, when containing about ten per cent. of metal, he adds, either before the melting thereof, or during the melted state, from 100lbs. to 150lbs. of sulphate of lime, or of soda, or of barytes, or of potash; and he keeps the whole in a melted state until the regulus becomes separated from the earthy matters. The use of the substances above named produces a regulus richer in metal than that obtained by the usual operation; at this stage the furnace is tapped either into sand or water; but sometimes a carbonate or oxide ore is previously added, by which means a regulus still richer in metal is obtained.

The product thus obtained is treated in the way usually practised by smelters, in order to obtain the metal; but what he (the patentee) prefers is, to treat it in the manner hereafter directed, and he observes that, although he has only spoken of copper, a corresponding treatment is likewise applicable to the sulphuret ores of silver and of antimony, only with this difference, that when he operates upon the sulphuret ores of silver he adds from five to ten per cent. of scrap iron; he also emphatically states that, although he has mentioned only the sulphates of lime, soda, barytes, and potash, the sulphurets of these substances, as well as other sulphates and their sulphurets, may nevertheless

be employed to produce the same effect, but not with the same advantage. In treating the regulus or product obtainable by the means already described, with a view to obtain the metal at one operation of smelting, the principle on which the patentee acts is, to mix with a regulus or with a sulphuret of copper such a metallic compound that the oxygen therein contained shall desulphurize the sulphuret in the act of melting, and so allow the metal to separate; and he prefers to employ for this purpose either a carbonate or an oxide of copper, whereby he obtains copper fit for refining by the ordinary process, or he employs a carbonate or oxide of zinc, in which case a great part of the zinc will be found to form an alloy with the copper. In all cases when employing zinc to produce an alloy he uses a flux, that is hereafter described. The patentee prefers to use an oxidized compound of copper when operating upon the sulphuret of copper, or an oxidized compound of some metal as the sulphuret under treatment, but finds that the sulphates of copper, of iron, and of zinc, will also answer, requiring to be used, however, in larger proportions than the oxide, and he therefore does not find them so advantageous. When he wishes to obtain an alloy, as of copper, for example, he uses, in preference to an oxidized compound of copper, an oxide of the other metal to be alloyed with the copper, but does not confine himself to any particular oxidized compound of metal, so long as the same is capable of acting in reducing a sulphuret of metal as explained. When reducing a regulus or sulphuret of copper, containing thirty per cent. or thereabouts of copper, he prefers to use either a carbonate or an oxide of copper, containing about the same per centage of metal, in which case he takes equal proportions, by weight, of the two matters; but, in case the sulphuret contains more sulphur than is equivalent to the oxygen contained in the oxide, he adds a larger proportion of the oxidized compound. For the purpose of carrying out this process he first introduces the sulphuret into the furnace and uses it, removing any slag that may be formed previously to introducing either the oxide or carbonate. This the patentee does by degrees, the slag being from time to time removed. He now gradually adds about ten per cent. of a flux, composed of carbonaceous matter, and chloride of calcium, or chloride of barium, in equal proportions, and in about three to six hours the sulphuret will in general be decomposed, and the metal become separated. If an ore containing an excess of sulphur be operated upon, as is frequently the case with poor ores of copper, the patentee prefers to obtain the copper in a state of regulus by the means described; then, in order to ascertain the quantities of sulphur and of oxygen, respectively, in the different compounds to be employed, he analyzes them. In all cases he prefers to have the sulphuret rather in excess, and thus allow a small portion of the sulphuret to remain undecomposed (by a small portion he understands two or three per cent.), and this remaining sulphuret he introduces into the next charge. When a sulphuret of antimony, containing much earthy impurities, is to be acted upon, it is to be fused in the manner already described for obtaining a regulus of copper, and the product then calcined, at a low temperature, in order to obtain an oxide of the metal; the oxide thus obtained is mixed with about equal proportions of sulphuret of antimony not calcined, the two being fused, with the addition of flux as for copper, and thus obtains the metal. In place of employing oxidized compounds of metal, as the means of decomposing sulphurets of copper at one operation by melting, the patentee sometimes employs the oxygen of the air; he acts, for this purpose, on a melted regulus of copper, or he places the sulphuret in a reverberatory furnace, and, by aid of suitable blowing apparatus, causes a blast either of hot or cold air (but prefers a hot blast) to be introduced, either through holes in the fire, bridge, or else in the roof, or other suitable parts of the furnace, and so to come in contact with the melted mass, removing the slag from time to time as produced, and so proceeds until the sulphuret is decomposed, and the metal is caused to separate. In treating the sulphuret of silver he proceeds much in the same way as that employed for treating the sulphuret of copper, but with the addition of the five to ten per cent. of scrap iron, as already observed, and which scrap iron he prefers to use along with a carbonate of copper or a carbonate of zinc. The improvements in coating iron and steel consist in the use of an alloy composed of about nine parts lead and three parts antimony, or of about nine parts lead, about one of tin, and about one of antimony, and he fuses these alloys in a convenient vessel, and keeps them in a melted state under a flux, composed of chloride of barium, or of sodium, or of the two combined, and he prefers to have such flux of considerable depth upon the melted alloy. In order to coat therewith he first carefully cleans the articles, and then immerses them in the melted metals until the desired coating is obtained.

PATENTS INITIATED FOR ENGLAND UP TO THE WEEK ENDING DECEMBER 4, 1848.

Robert Nelson Collins, of Oxford-court, Cannon-street, druggist, for certain improved compounds to be used for the prevention of injury to health under certain circumstances. Patent dated December 2d, 1848; six months.

James Taylor, of 15, Furnival's-inn, gentleman, for improvements in propelling ships and other vessels. Patent dated December 2d, 1848; two months.—(Communication.)

John Henderson Porter, of No. 2, Adelaide-place, London-bridge, engineer, for an improved mode of applying corrugated iron in the formation of fireproof floors, roofs, and other like structures. Patent dated December 2d, 1848; six months.

John Daley, of Northampton, ironfounder, for certain improvements in the construction and arrangement of stoves for cooking and other purposes. Patent dated December 2d, 1848; six months.

Thomas Drayton, of Regent-street, practical chemist, for improvements in silvering glass and other surfaces. Patent dated December 4th, 1848.

Frederick Collier Bakewell, of Hampstead, gentleman, for improvements in making communications from one place to another, by electricity. Patent dated December 2d, 1848; six months.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, merchant, for certain improvements in machinery or apparatus for winding, balling, or spooling, thread, yarn, or other fibrous materials. Patent dated December 2d, 1848; six months.

Francis Hastings Greenstreet, of Liverpool, engineer, for certain improvements in hydraulic engines. Patent dated December 2d, 1848; six months.

John Armstrong, of Edinburgh, brassfounder, for improvements in constructing water-closets. Patent dated December 2d, 1848; six months.

George Armstrong, of Newcastle-upon-Tyne, Esq., for certain improvements in steam-engines. Patent dated December 2d, 1848; six months.

Robert Burn, of Edinburgh, for an improved roller gin, used in separating the seed from cotton. Patent dated December 2d, 1848; six months.

John Davies and George Davies, of the Albion Iron Foundry, Staffordshire, ironfounders, for improvements in steam-engines. Patent dated December 2d, 1848; six months.

PATENTS RECENTLY EXPIRED.

W. Ranger, of Westminster, builder, for certain improved modes of preparing and combining various metals, whereby the moulding or forming blocks, casts, walls, or other aggregates in these said materials may be considerably expedited, being improvements upon a patent granted to him for Ranger's Artificial Stone. Patent dated December 4th, 1834; expired December 4th, 1848.

J. Hudson, of Gale, calico-printer, for certain machinery and apparatus applicable in block-printing on silk, woollen, cotton, and other fabrics, and on paper. Patent dated December 4th, 1834; expired December 4th, 1848.

J. West, of Crayford, blacksmith, for an improvement in forges. Patent dated December 9th, 1834; expired December 4th, 1848.

E. Massey, sen., of Clerkenwell, watchmaker, for certain improvements in the apparatus used for measuring the progress of vessels through the water, and for taking soundings at sea. Patent dated December 9th, 1834; expired December 9th, 1848.

F. A. Bernhadt, of London, architect, for certain improvements in warming and airing buildings. Patent dated December 4th, 1834; expired December 4th, 1848.

W. A. Noble, of Bermondsey, engineer, for certain improvements in applying the steam to the common and other engines. Patent dated December 4th, 1834; expired December 4th, 1848.

MISCELLANEOUS CORRESPONDENCE.

ALKALI WORKS *v.* VEGETATION.

[To the Editor of the Chemical Times.]

Sir,—The recent decision by arbitration of the case of the Walton Soap and Alkali Works, where Sir William Pilkington and Mr. W. Waterton were the plaintiffs, and Mr. E. T. Simpson, the defendant, has excited a great interest in Yorkshire, and the chemical manufacturers in various parts of the country may now expect a series of persecutions, and Professor Lindley, who was a witness of the plaintiffs, and who counsels all who have timber or crops to proceed against them, conceding nothing, compromising nothing, but forcing them into court. The *Gardeners and Farmers' Journal* took up the professor and administered a castigation which he is still writhing under; and in the last number urges alkali-manufacturers that, as the two plaintiffs *combined* to persecute and ruin the defendant, the alkali-manufacturers should do the same, and thus be able to resist any harassing and fictitious demands. The following, as a history of the case may be interesting to your readers, is taken from the journal above mentioned:—

"The working of the salt-cake furnace commenced in the month of March, 1844, and in October, 1846, Mr. Waterton and Sir William Pilkington had some fears as to condensed muriatic acid injuring the water. It was immediately proposed to stop any part of the works which any scientific person thought might be injurious to vegetation or otherwise; in fact, this process was given up, but, to the surprise of the owner, two actions were commenced against him; one by a tenant of Mr. Waterton's and another by a tenant of Sir W. Pilkington's, both of whom admitted, on their evidence, that they did not know of the actions being commenced, or did they ever complain or ask for compensation or damages for the damage which these plaintiffs alleged to have sustained. One shilling damages was awarded in each action, which, unfortunately, carry costs. These actions, as will be remembered, were to be tried in March Assizes, 1847, but were then referred, taking in all other matters in difference, not only as between the plaintiffs in the action, but also as between Mr. Waterton and Sir William Pilkington, and the defendant.

"As regards the salt-cake furnace, which was only working in the whole about eighteen months, and then not during the night, in order to prevent any escape of muriatic acid gas into the air, it was built on Gamble's patent, which is so constructed as to prevent any escape of gas, except through a flue which is separate and distinct for the fires. That flue conveys the gas through a condenser, through which condenser there ran per hour 500 gallons of cold water, and during

the night, when the works were not going, about one half that quantity of water ran through the condenser. Notwithstanding this, however, the plaintiffs in the actions failed in proving that this had caused any substantial damage, and, consequently, they have only got one shilling for such damage in each action. The condensed muriatic acid gas might give the water in the beck a very slight acid taste, as there were per hour running down the beck upwards of 10,000 gallons of water, with which the acid water which ran from the condenser intermixed. On the reference a new feature sprung up as to the injury to crops and trees, arising from the escape of smoke and vapour from the works; and it will be well here to state that the defendant and his predecessors have carried on the trade of soap and alkali manufacturers for upwards of thirty years, and the manufacturers of vitriol for about ten years, before the commencement of the action. As regards the soap and alkali manufacture, and also the vitriol, every possible caution has been taken to prevent any escape of gas, and in trying the flues none could be perceived. This was ascertained by persons putting their heads into the flues leading from the vitriol-chamber during the time the works were in full operation, and they could with perfect ease both breathe and talk. Under such a state of things, it would be impossible for an escape of injurious gas; in fact, every one knows what effect a lighted match would have upon the nostrils. This portion of the works has also been examined by an eminent chemist, and since the conclusion of the evidence in the arbitration by some of the plantiffs' witnesses, and they all positively asserted that there could possibly be no escape of gases which could injure vegetation.

"The arbitrator has, however, awarded damages to Sir William Pilkington, for injury to trees, £10 7s.; to tenants' crops, £23; for injury to Mr. Waterton's trees, £1,002 10s.; and for damages done to his house by smoke and vapour, £100; and for injury to tenants' crops, £5.

"From the above it will be perceived that the defendant will have to pay £1,130 19s. damages, and the award also saddles him with the whole of his own costs, and half the costs of the plaintiff, to be taxed by the master, and he has also to pay a portion of £528, the arbitrator's costs.

"Notwithstanding that the defendant has to pay these damages, it has been affirmed, after every possible examination has been made, by two of the highest authorities of the day on chemical science, that there never was, nor is there now, anything escaping from these works injurious to vegetation or trees, and that there never was any escape from these works, except what might arise from the coal consumed on the premises, and every means has been adopted to burn the smoke.

"In justice, however, to the arbitrator, it is admitted that a witness who was examined on the plaintiff's behalf swore that the trees in the neighbourhood were dead and dying from the escape of gas, which could only come from the works at Walton. He was requested to point out, and did point out, many trees as having been so injured which had been in a decaying state for upwards of twenty years. He also stated that the leaves on the fences had a scorched appearance; but it will be recollected that the salt-cake furnace had not then been working for nearly twelve months. The investigation of the same witness was in September, 1847, and the furnace had not been working since October in the year before. Another witness swore more positively as to the damage done to vegetation. Other witnesses partly supported the same view.

"Professional and practical men of the highest authority and acknowledged experience, from Edinburgh, from London, &c., were called by the defendant, who swore positively that a great number of the trees complained of had been decaying for upwards of ten and twenty years, and as regards the rest of the trees and vegetation there was no appearance whatever of injury from gas, and that in those trees which did not appear healthy the injury arose from natural causes; and that the appearance of the vegetation and trees in the neighbourhood in general was as healthy as any other district in the West Riding of Yorkshire, except the instance of two ash-trees near the works which had been injured by the acid water running from the condenser over the roots.

"The proprietor of the works in question has been advised to authorize the publication of this statement for the express purpose of explaining to the trade and the public the real facts of the case; and should any one, either connected with the management of similar works, or other persons, wish to examine the construction and arrangements of the works which have been the subject of such expensive litigation, they are welcome to do so, that they may judge for themselves as to the possibility of these works being injurious to vegetation; and if they are to be considered injurious, or that smoke, which will travel for miles, is injurious to a gentleman's dwelling-house, so as to obtain a £100 damages, it certainly is not easy to see how manufactures, the very foundation and stability of this country, can be carried on.

"In addition to the above, though it does not bear directly on this case, it is significant of the spirit in which the action has been carried on to remark that the dwelling-house in which the defendant resided was purchased over his head, and himself and family turned out in the midst of winter; that the stables which he rented for his cattle—that the small portion of land which he occupied as an accommodation for them—that the water which he had from the Barnsley Canal Company, for the purpose of carrying on his works—were taken from him; and the greatest part of the inhabitants who were expected to be called as witnesses on his behalf, and his workmen, had notices to quit their dwelling-houses, and, consequently, many parties refused giving valuable evidence, fearing they might lose their farms or dwellings."

It is not necessary to say more on the hardship of the case.

Yours truly, SCRUTATOR.

[To the Editor of the Chemical Times.]

Sir,—Innumerable questions are weekly inserted in your journal requiring answers which frequently involve, or closely border upon, the substance of a patent, or on the secret processes of an establishment, the publication of whose methods would immediately destroy its ascendancy over its competitors engaged in the same branch of trade. Such secrets are little likely to be elicited from mere practical men, who, as long as any particular method or plan of manipulation remains a mystery, undoubtedly deserve to derive alone the benefit of their industry or chemical talent, and who are seldom ambitious to prefer notoriety to pecuniary satisfaction. Many proprietors of works in any manner related to chemical processes, it must be remembered too, have the wisdom to employ a chemist to conduct their business, whose attention is ever alive to introduce improvements into his methods. Now, definitive chemistry professes to be, at once, the monitor and assistant of practical men, and we are assured that it is the alliance of science and art in this peculiar sense that the CHEMICAL TIMES is designed to accomplish, and not the publication of the processes of men merely practical to men merely practical.

Let us intimate to non-chemical correspondents that a rational and discreet chemistry, conducted with a definite end in view, is calculated to answer the same question a number of different yet accurate ways, provided these questions be reasonably presented and assisted by means adequate to effect their solution. On such occasions of difficulty, unanswerable by the manufacturer, the chemist ought to be consulted, and we are certain there would be few difficulties remain long as insuperable obstacles to the rapid progress of chemical manufactures and arts.

"Chemicus," in your last, desires an easy method for bleaching his tallow. He mentions one of the many well-known methods (sulphuric acid and bichromate of potassa) for extricating an abundant supply of oxygen for the purpose; but he is unable to separate the deposit resulting from the reaction, and by consequence suffers a considerable loss, merely from inability to separate the agent from the fat. Well-conducted experiment alone can answer such questions as these. Experiment requires time, opportunity, and money. Now, these questions either must remain unanswered, or answered by the generosity of the solely practical, or referred to their proper and legitimate province—the domain of experimental chemistry. Has the nature of the sediment been examined? Is it oxide, sulphate, or a soap?

CHEMICUS A.

MISCELLANEA.

INTRAMURAL INTERMENTS.—On Tuesday the commissioners appointed under the City Sewers Act, which comes into operation on the 1st of January next, caused notices to be served on the incumbents and churchwardens of parishes within the City precincts, warning them, under penalty of £20, not to permit any interment within their jurisdiction wherein the space from the top of the coffin to the surface of the grave is less than five feet; nor to allow any corpse to be placed in their church vaults or catacombs unless enclosed in a leaden coffin, or a double wooden one, having pitch half an inch in thickness between the outer and inner case. Undertakers aiding interments contrary to the above are liable to the same penalty.—*Globe.*

MUSK.—Musk is procured from the musk-deer, Moschus moschiferus, a native of the East, and from the musk-rat, a native of America. It is imported in the natural bags, which are taken from behind the navel of the deer, and are about the size of a pigeon's egg. Those from China are thin, and covered with brownish-yellow hair; those from Russia and Bengal are thick, and covered with white hair, being probably taken from old animals. Musk is imitated by dropping 3½ drachms of nitric acid on 1 drachm of rectified oil of amber. In the course of a day a black substance is produced, which smells like musk. Or, take two parts of any fetid animal oil procured by distillation, and one part of nitric acid, digest for eight or ten days, add gradually 32 parts of rectified spirit of wine, and digest again for four weeks. The substance thus procured is very like genuine musk. Musk is adulterated very extensively with dried blood, asphaltum, ammoniacal salts, and a sort of resin. In China the musk-bags are often cut open between the hair, part of the contents abstracted, and the deficiency made up with dried blood, rolled up into pills, so as to imitate the true grains of musk. The bags should therefore be carefully inspected before selection. The presence of dried blood may be known by its emitting a fetid vapour, on the application of heat. When asphaltum is present, it will melt and run on the knife point before it inflames, whilst genuine musk does not melt, but is turned into charcoal. Punctures difficult of detection are also made in the bags, and through which sand, small stones, and even pieces of lead and barytes, are introduced to increase the weight. These are easily discovered by inspection. Other musk-dealers, less fraudulent in spirit, leave the bags in a damp place, to increase their weight, and this also injures the musk. The musk from Holland is brought in leaden pots sewed up in canvass, and is nothing more than dried blood mixed with a little oil and tincture of musk. It is generally very moist, and exhales a disagreeable urinous smell. The artificial bags may be known from the genuine by wanting the internal membrane or skin. It is also adulterated with spikenard, chocolate, aloes, nutmeg, storax, &c. According to Dr. John Davy it is always impure if it exhale an ammoniacal odour when mixed with quicklime. According

to the same author, genuine musk, from China, is of the colour of an old brown nutmeg, rolled up in little round friable pills. Russian musk, even when good, is not in form of pills, but loose in the bag, and has a urinous odour. To preserve it well it ought to be kept perfectly dry; but moistened when it is to be used as a perfume. Chemically, musk contains resin, combined with the odoriferous volatile oil, to which its perfume is due, besides several animal matters. It is soluble in sulphuric ether, and in boiling water; also in alcohol and sulphuric acid with the loss of its odour. Added to other odoriferous substances, such as lavender-water, it increases their odour, as ammonia often does from its volatility.

Production of Cotton in India.—The report of the committee of the House of Commons on the growth of cotton in India, together with the minutes of evidence, has recently been issued from the office of the parliamentary printers. The report states that of the witnesses examined by the committee fifteen spoke from a personal knowledge of India, and on the strength of experience in the service of the East India Company in various departments. The committee do not consider it necessary to enter into a minute historical account of the extent to which cotton has been grown in India in past times, or to trace in any exact detail the various measures by which the East India Company has endeavoured to stimulate the production of this article. It appears that over a great portion of the Indian peninsula cotton has for ages been produced in large quantities, chiefly for the consumption of the native population. The internal consumption has been for ages past enormous, and considerable quantities have for many years been exported to China and England. The committee, adverting to the difference of opinion as to the possibility of adding materially to the growth of cotton in India, and the power of selling it in competition with the produce of America, state their belief, as the result of their very minute and careful inquiry, that amongst those who during a long residence in India have made this interesting question an object of especial investigation there exists a strong conviction that the cultivation of the plant may be greatly extended, and its quality so much improved as to enable it to stand a fair competition with that of the United States of America. The result of the experiments made for the improvement and cultivation of indigenous cotton has clearly established that not only does the American plant grown in India produce a staple longer, and therefore better calculated for the European manufacturer, but that it can be grown on land of a poorer description than the native cotton, and is therefore liable to a lower rate of assessment. In the Bengal Presidency, the north-west provinces, and the great cotton district of Broach, in the Presidency of Bombay, no success has hitherto been obtained in cultivating the American cotton, but it has been introduced with perfect success into the southern Mahratta country within the Bombay Presidency, and into the province of Coimbatore, with perfect success. While the result of these experiments has satisfied the hon. committee of the power of India to supply England with cotton of a very improved quality and to an indefinite extent, they feel bound to state that they do not expect that by these means alone its cultivation will be greatly extended or its quality improved. They opine that the subject must be taken up by men of capital and enterprise, and that it is chiefly, if not solely, to British capital and intelligence that any permanent improvement must be looked for in the quality or the increase of production. After entering into some details, and particularly dwelling on obstacles presented to the cotton trade in India by the want of suitable means of internal communication, the committee thus conclude their report:—"In reviewing the whole of the case submitted to them, your committee have much pleasure in expressing their entire disbelief in the existence of any insuperable obstacles to improvement in the character and habits of the native population. It may be granted that the natives are not so readily induced to change their customs, and to adopt new modes of cultivation and artisanship, as are the people of some other countries; and there is evidence to show that many of them are improvident, and frequently encumber themselves with debt by extravagant expenditure at their marriages, and on other occasions, or in the performance of ceremonies connected with their religion; but, on the other hand, it is established by much concurrent testimony that where there is a fair promise of a successful result, and where security of reward is offered to them, the natives of India will exert themselves even to the abandonment of customs to which they are greatly attached. Some striking evidence has been adduced to show the aptness of the native population to learn the trades practised by Europeans; and it is hardly necessary to refer to the fact that many offices of responsibility under the Government are now filled by natives, and that, in the commercial cities of India, many mercantile firms are composed in part or altogether of natives of the country. In dismissing this subject, your committee have much pleasure in expressing their opinion that under the continued encouragement now afforded by the Government of India, and by taking full advantage of all the resources which are still within reach, there may eventually be opened to the manufacturers of this country a large and regular supply of cotton of a quality largely consumed by the British manufacturers, which will, by giving them additional sources of supply, render them more independent of the failure of crops, and thus have the double effect of equalizing the price of the raw material, and of lessening those fluctuations in the market which have occurred for some years past, and which have acted so injuriously on the energies of our manufacturing population." The list of witnesses examined before the committee includes the names of Mr. F. W. Prideaux, Dr. Royle, Mr. Bazley, Mr. A. Turner, Major Briggs, Mr. R. W. Crawford, Mr. Mangles, M.P., Rev. Dr. Lang, Captain Reynolds, Mr. Sullivan, Mr. B. Blaine, &c.

Varnishes. — Copal Varnishes are made in various ways. The best is made cold by dissolving pure copal in essence of rosemary, and then adding a little alcohol, letting it stand to settle, and pouring off the clear liquid. This does for wood, pasteboard, paintings, and metal. Crystal Varnish is a solution of 3 oz. of mastich in 1 pint of rectified spirit. Furniture Varnish: Dissolve 3 pounds of resin, 2 pounds of turpentine, and 10 pints of linseed oil, over a slow fire, and, if too thick, soften it with oil of turpentine. Indian Varnish is composed of 5 oz. each of shell and seed lac, dissolved in 2 pints of rectified spirit. Italian Varnish is Venice turpentine boiled till it become brittle, when it is finely powdered, and dissolved in oil of turpentine. Mastich Varnish is composed of 2 oz. of mastich dissolved in 1 pint of oil of turpentine.—(See Crystal Varnish.) Painter's Cream is prepared by dissolving ½ drachm of mastich in tears, pulverized in 3 oz. of nut oil; add this to ⅓ oz. of acetate of lead, in a marble mortar, and stir, adding gradually a little water, till it becomes creamy. Picture Varnish is made by dissolving 12 oz. of mastich, 2½ oz. of Venice turpentine, 30 grains of camphor, and 3½ pints of oil of turpentine together, and pouring off the clear liquor from the dregs. Or, 1 oz. of matich in drops, ½ pint of very clear oil of turpentine, and 3 drachms of nut oil without colour. Print Varnish is made by adding 1 pound of copal in powder by single ounces per day to 4 pounds of balsam of copaiba, keeping in a warm place, and frequently stirring. When dissolved, add a portion of Chio turpentine.—(Le Blond.) Red Varnish is made with mastich, benzoin, sandarac, seed-lac, turpentine, and rectified spirits, dissolved in the usual way. Spirit Varnishes are all those made with rectified spirit. Tamao Varnish: Dissolve gum copal by digestion, in a gentle heat, in linseed oil rendered drying by quick lime.

TO OUR SUBSCRIBERS.

*** Subscribers are respectfully informed that the proprietors of the *Chemical Times* will not compound for payment in advance. The great difference between one guinea for advanced payment and twenty-six shillings, as established by the proprietors of the *Pharmaceutical Times*, naturally created the most painful suspicions, and has exposed the proprietors of the *Chemical Times* to some annoyance. In abolishing the ill-judged and improper system we trust that the subscribers to the *Chemical Times* will accept our renunciation as a guarantee of the good faith which we desire to subsist between ourselves and them.

TO CORRESPONDENTS.

We regret that press of matter this week has prevented our answering a long list of questions directed to us by correspondents.

"Mr. Warrington" is thanked for his communication.

"Mr. Hall Maxwell's" request has been attended to.

"Mr. Crossley" sends us a letter and extracts, both of which we have perused. Mr. Crossley is assured that the "imparting of extra saccharine matter to sugar is about the parallel of imparting extra saline matter to salt." If a person were to eat a teaspoonful of salt and to proclaim that it had not much *saline!* the expression would not be at all more absurd than the expression so commonly heard that such and such sugar has not much *saccharine!* Mr. Crossley's plan of boiling sugar in open pans by injecting through the boiling mass a current of atmospheric air is ingenious, and produces a good result; but we fear the long period required for evaporation will be a great obstacle in practice. Mr. Crossley is very much in error to suppose that carbonic acid plays any part in his operation, which is purely physical, and due entirely to the evaporative agency of atmospheric air. Our correspondent may take it as a proposition admitted beyond question, or challenge, that mere improvements in sugar-boiling will effect but little good so long as the juice to be operated on be not thoroughly defecated. All those desirous of ameliorating the sugar produce should turn their attention in this direction.

"Justitia."—No duty is leviable, but a licence is required.

"A Subscriber, Aberdeen."—Zinc may best be amalgamated by first dipping it into strong undiluted sulphuric acid, and then into a trough of mercury. This operation, however, demands a considerable amount of the latter material. Another plan consists in rubbing the zinc previously cleaned with the solution of the proto-nitrate of mercury.

"W. B. M."—An article on the use of symbols shall speedily appear. To make unfermented bread proceed as follows:—Divide 8 lb. of flour in two proportions, mix up the first with water holding in solution 2 oz. of bicarbonate of soda, and the second with the other portion, to which 1 oz. of hydrochloric acid has been added. When each mass of dough has been separately well kneaded to a proper consistence mix them together as quickly as possible; form the mass into loaves and bake them at once.

"A Constant Reader."—The book is a good one, and may be procured by an order given to any bookseller. It is published at Longman's. We are not aware that a new edition is expected.

"Mr. Peter Dennison" is informed that narceine was discovered in 1832, by M. Pelletier, in the ammoniacal waters after the precipitation of morphia, by evaporating these to a thick syrup, crystallizing, treating the crystals with alcohol, distilling, and again crystallizing, when both narceine and meconine are formed. The first is separated by water. The crystals are white, without smell, and of a bitter metallic taste. Its medicinal effects have not been much investigated.

"A Dispenser."—Genuine blue pill should have the odour of roses, also a pleasant taste, and, when spread out thinly with a drop of water on a marble slab or piece of paper, no globules of mercury should be recognisable. The mass is prepared at Apothecaries'-hall by a machine consisting of an iron mortar and four wooden pestles, driven by a steam-engine. This operation both triturates and rolls the mass, and the pills are said to be stronger than those made by the hand.

"Mr. Thomas Ward."—Oleum Succini, L. E. D. P. Oil of amber. Put a portion of amber into an alembic, so that from a sandbath gradually heated an acid liquor, an oil, and a salt, impregnated with the oil, may distil; then let the oil be distilled a second and a third time. Adulterated with petroleum, sometimes to the extent of two thirds. When genuine it is nearly colourless, has a strong, unpleasant, bituminous smell, and a pungent taste. When old, or not redistilled as above directed, it is thick and dark coloured.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—December 16, 1848.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,*
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 58.]

At this stage of our subject it is necessary to describe two grand agents, one physical, the other chemical, to which much amelioration in the sugar manufacture is due. I advert to the vacuum-pan and animal charcoal.

This description I think it necessary to make at once, in order that no misunderstanding may arise hereafter, when I shall have occasion to reprobate the application of these agents out of their just and legitimate sphere. Having lived nine months in a refinery with the object of acquiring a practical as well as a chemical knowledge of sugars,—having there witnessed the all but magical effects of animal charcoal and the vacuum-pan,—the very terms I employ in the designation of these agents are the best guarantee I can offer that I entertain no prejudice against either. It will be hereafter my duty to show, however, that in the colonies both have been sadly misemployed; forced into the accomplishment of ends totally beside their genius,—abused for imperfections which they were not competent to obviate,—praised for effecting results that were due to other causes.

But I will describe the nature and construction of the vacuum-pan, after which the intelligent mind will recognise the cases to which it can, and those to which it *cannot*, with propriety be applied. First, as to the principle of the vacuum-pan. The usual operation of boiling, as we are well aware, is accomplished by the application of heat; hence such application of heat is thought in general to be a necessary condition, and all our current ideas of boiling have reference to this application of heat. The idea is unsound: it will not bear scrutiny. Chase it from the mind.

The proposition is this—boiling is merely the act of generating steam with such rapidity that the formation of bubbles is the result. What causes this evaporation? The preponderance of the repulsion between particles over the combined effects of cohesion and pressure. What causes this repulsion? Heat. Then, is not the application of heat a necessary cause of boiling? No. The usual cause it certainly is, but not the necessary or universal one, inasmuch as there does not exist a material body, whether solid, liquid, or gaseous, that is totally without heat,—heat being, not a positive, but a relative term. Chemists, for example, are acquainted with bodies so much colder than ice that the latter is hotter in proportion than red-hot iron is to ice itself. Hence the rapidity of evaporation of liquids may, as a rule, be increased by one of two methods—either by adding so much heat as shall enable their particles to overcome the combined uniting tendencies of atmospheric pressure and cohesion, or by removing the atmospheric pressure, and thus enabling the fluid's own natural heat to accomplish the same result. Under these latter circumstances many liquids may even be made to evaporate so fast that boiling ensues; and all thus treated can be made to boil at a diminished temperature.

Belonging to the first division, or to the liquids which boil in vacuo—by their own heat—is ether; belonging to the second division are water, aqueous solutions of sugar, &c. The conditions here detailed as influencing and determining the evaporation of liquids can be demonstrated by some curious and seemingly paradoxical experiments. Thus, under proper circumstances, water may be made to boil by the application of coal, and to cease boiling by the application of heat; and certain liquids may be made to boil under the same conditions that cause others to freeze. For example, if a Florence flask be filled two thirds with water,—the water boiled by the application of heat, and whilst boiling tied over with a piece of bladder, so that all egress of steam or ingress of air be prevented,—it is evident that, on dipping this flask into cold water, the steam pervading its upper third will be condensed, a partial vacuum will be the result, and the water being as yet but slightly cooled, there will exist the conditions necessary to its rapid evaporation. Such evaporation, therefore, takes place, and with such rapidity that the water boils.

The second result obtains when an open tube containing ether is inserted into another containing water, in such a manner that a thin film of the latter liquid remains between the two tubes,—and the atmospheric pressure is taken off both by means of the air-pump. Under these circumstances the ether evaporates so rapidly that not only does the vapour eliminated carry off a portion of the natural heat of that fluid, but also such an amount of the water's heat that this liquid congeals into ice.

In the laboratory, the principle of promoting evaporation by means of a vacuum is constantly applied by the chemist in thousands of delicate operations, involving the removal of liquid under circumstances when the application of heat would be injurious. The chemist proceeds thus:—Under the receiver of an air-pump he places a shallow pan containing oil of vitriol, a liquid which possesses a remarkable tendency to combine with water, either vaporous or otherwise. Above this pan of oil of vitriol, but not in contact with it, is placed the material to be dried, and a partial vacuum is created. The air being pumped away, the receiver now becomes pervaded with vapour, with which latter the oil of vitriol immediately combines, and, by so combining, renews the partial vacuum as before, and a similar recombination. Thus, without any new working of the pump, the generation goes on until the end, when the evaporative process is complete. It is very evident that such an operation cannot be conducted on the large scale,—hence that it is totally unadapted for the commercial production of sugar.

The vacuum-pan, however, effects a very good practical compromise. It enables sugar solutions to be boiled at so low a temperature, about 135, that if the juice be pure, especially if it be free from lime, the usual deteriorating influence of the process of boiling is reduced to its practical minimum.

The construction of the vacuum-pan and its mode of action will now be readily understood. It consists of two spherical segments of copper, the lower one buried in a steam-jacket externally, and supplied with a spiral coil of metal internally, both of which are for the purpose of applying the necessary degree of heat by means of steam. The lowest part of the lower segment is furnished with a valve, through which the sugar may escape when sufficiently boiled. The upper segment is provided with a man-hole, an interior tube, through which the solution is made to enter, and perforations for a pressure-gauge (usually called, when thus applied, a *vacuum-gauge*);—two circular glass plates, termed sight-holes;—for a pipe of communication with a reservoir of communication with the air-pump; and for a very ingenious contrivance called the proof-stick, by means of which a portion of the solution, whilst boiling, may be from time to time removed, to see how the operation proceeds within, without allowing the air to enter.

Between the vacuum-pan and the condenser which joins the air-pump, destined to effect the vacuum, is a reservoir, called the *overflow-vessel*, intended to retain any of the liquor which may boil over, as it sometimes does. From the upper part of this vessel there is a direct communication with the air-pump. From the upper part of the overflow-vessel a pipe proceeds to the condenser, which latter is a contrivance for injecting streams of cold water into the steam as it is drawn in by the air-pump. Thus this stream of cold water corresponds in efficacy to the oil of vitriol used by chemists in their vacuum-evaporative processes; and the air-pump, as it is called, serves to draw off the water resulting from the condensed steam, and that from water of condensation; also such steam as may have remained uncondensed, and any air which may enter by leakage from time to time. Thus a diminished pressure during the whole operation is maintained.

The vacuum-pan was the invention of the Hon. Mr. Howard, who, however, derived but little benefits from the discovery, although towards the conclusion of the patent term the royalties for licences to use it amounted to nearly thirty thousand pounds per annum!

The true method of boiling in vacuo is, like most other refining matters, held in great secrecy. The boilers are for the most part Germans, and so jealous are they of their art that they strive by all means in their power to create the idea of their being alone competent to conduct the operation. The process of vacuum-boiling undoubtedly requires practice to do it well, and, inasmuch as the material to be boiled is expensive, a good vacuum-boiler is invaluable in a refinery. The operation, however, is soon learned by any intelligent person, even if he be ignorant of the theory of its agency.

The plan pursued is this:—A certain portion or charge of liquor being conveyed into the pan, the vacuum is made and the steam turned on. Ebullition soon takes place, and the boiler from time to time takes a proof, as it is technically called, of his work.

By means of the proof-stick he withdraws from time to time a portion of the sugar solution, places it between his finger and thumb, separates the two, and observes the appearances which the boiled liquor presents. If it break short, that is to say, if on separating from the finger and thumb it do not form long strings,—if the crystals or grains speedily form, and the colour be but little heightened,—the operation proceeds well, and the liquor was good. If, however, the strings be long, the sensation of the boiled mass clammy (or smeary, as the refiners call it), the grains small, all these are bad indications.

In order that these appearances may be seen to the greatest advantage, the boiler has beside him a lamp or candle, by the transmitted light of which he views his proofs. When the crystal has once formed, fresh charges are added, little by little, until the pan is sufficiently full. In adding these successive charges care is taken never to dissolve the grain when once formed. In this care, in fact, resides the greatest art of vacuum-pan boiling. When the operation has been continued sufficiently long the sugar is discharged by opening the valve in the lower segment of the pan into a vessel called the heater, where, by means of steam heat, it is raised to the temperature of about 175 to 177° Fahrenheit, being stirred about during this period by a wooden oar. The use of this heating operation consists in affording time for the crystals of sugar formed up to a certain size in the vacuum-pan, to accrete into still larger dimensions. Having remained in the heater sufficiently long, the crystallizing mass is conveyed by means of copper vessels, something like coalscuttles, to the moulds; which, having been previously stopped at the apices with pledgets of brown paper, are standing ready in rows to be filled.

[*To be continued.*]

* Dr. Muspratt's Lecture next week.

To Distinguish Good from Bad Scammony.—Genuine scammony is black or dark grey externally, becoming yellowish-white when moistened with the finger, and when broken appearing shining and of a grey or greenish-brown tint. It has a smell of cheese, and may be easily powdered. When very soft, smell disagreeable, or none, and when it does not become easily milky by trituration with water it is bad. The best is from Aleppo, and is imported in drums of 100 pounds weight. The worst is from Smyrna in form of cakes. Scammony is frequently imitated by mixing together extract of jalap, senna, manna, gamboge, guaiac, sago, syrup of buckthorn, and colouring the mass with ivory-black.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXVII.

(LECTURE LXV.)

EXTRACTIVE.

The term "extractive," or "extractive matter," is applied to a certain substance extensively diffused through the vegetable kingdom, and which is characterized by its dark colour, amorphous state, solubility in water and weak alcohol, and insolubility in ether and concentrated alcohol.

It is to this matter that the medicinal properties of most plants have hitherto generally been attributed. But experience shows every day more and more clearly that, so far from being a simple principle, extractive is, on the contrary, invariably a mixture of several different matters; and that, so far from constituting the active part of a plant, it simply envelopes that part, and impedes its extraction.

This much is certain, however, that plants commonly contain a matter presenting the general characteristics attributed to extractive, singularly alterable, and which, when extracted from a plant, carries away with it almost invariably the active principle.

This matter is frequently found colourless in the vegetable juices, but it acquires colour more or less rapidly when placed in contact with water; it forms before our eyes by the alteration of tannin, by the decomposition of the gallates, and, undoubtedly, also in many other circumstances that are still ignored. In the state of doubt and uncertainty that hangs still over the subject, we cannot well avoid attaching great importance to the study of extractive, and we are obliged to examine and describe under a common head the substances that are most commonly used under that name; the more so as we find the solubility proper of the true active principles frequently modified, and even altogether changed, by the presence and influence of this matter.

Extractive is evidently colourless in some plants; it is, however, usually found of a more or less dark brown colour; its taste varies exceedingly. It dissolves in water in all proportions; it is insoluble in absolute alcohol; its solubility in dilute alcohol increases with the degree of dilution: hence the necessity to use weak alcohol for the preparation of a great many tinctures. It is insoluble in ether, and in the fixed and volatile oils.

When exposed to the air extractive suffers alteration more or less speedily. At the common temperature the alteration proceeds usually very slowly; from this rule there are, however, some remarkable exceptions. Thus, for instance, the extractive of Rhus radicans gets speedily black and insoluble upon exposure to the air; the extractive of nuts also promptly loses its original solubility. The alteration proceeds with particular rapidity if the solution of the extractive is exposed to the action of both air and heat; it is in such cases the more speedily that we approach the ebullition point of the fluid; oxygen is absorbed from the air and combines with a portion of the hydrogen of the extractive matter to water; in consequence of the molecular derangement resulting from this process, part of the oxygen and carbon of the extractive combine to carbonic acid; the proportion of this, however, is comparatively small; the substance which remains is richer in carbon than was the original extractive; it acquires a deeper and deeper tint, and forms at last insoluble pellicles, which constitute the oxygenated extractive of the ancient chemists, the apothema of Berzelius.

This apothema is brown and pulverulent; it is slightly soluble in boiling water, but separates again from the solution upon cooling (at least partially, as is clearly indicated by the turbid appearance of the water). It dissolves in the alkalis. The acids precipitate it from its alkaline solutions; the precipitates are compounds of the precipitating acid and the apothema. From these properties may be drawn the two following important conclusions or rules:—

1. Liquids charged with extractive matter ought to be evaporated as promptly as possible, and at the lowest temperature.

2. In its separation from the liquid, the apothema carries down with it in close combination other neutral, acid, or alkaline principles.

It must not be thought, however, that the deposits which form during the preparation of extracts are all of them of analogous composition; opium, for instance, yields an apothema composed of resin, oil, and narcotin. The apothema of the cinchona bark contains starch combined with tannin, and a compound of the red principle of cinchona with cinchonin and quinin.

Concentrated acids determine frequently precipitation of the extractive matter; alkalis, on the other hand, facilitate its solution. The alteration which extractive suffers in contact with the air is singularly hastened by the presence of alkalis. The metallic oxides form with extractive matter insoluble brown varnishes or paint. The lignin of the plant may combine with the extractive; this combination is often accomplished in the plant itself; it takes place invariably when plants are treated with water, and more particularly upon ebullition; in such cases actual tincture of the vegetable fibre is formed.

The plants, or parts of plants, which (according to the generally received notion) may be said to owe their medicinal properties to the extractive are very numerous. As regards the pharmaceutical preparations of extractive, it must be borne in mind that this matter is insoluble in strong alcohol, in ether, and in the oils, and cannot, therefore, form a part of any solution in either of these vehicles, nor can it form part of any distilled water or alcoholate, on account of its non-volatility. The preparation of the species, simple and compound powders, pulps, &c., from matters charged with extractive principles presents no peculiarity. It is a very different thing with the solutions of extractive, and the evaporation of the solutions; these present a high degree of interest, and claim our especial attention.

In some cases we find the solution ready formed in the tissue of the plant (extractive juices); in other cases we have to produce it by the action of water or some other vehicle upon the fresh or dried plants, or parts of plants. These processes of solution are by no means so simple as they would appear at first sight, various modifications being required in most cases to ensure the presence, or to effect the elimination, of the divers principles which accompany the extractive.

The solution of extractive matter may be evaporated to obtain the extract in the dry state. They may also become ingredients of compound preparations, such as syrups, mellites, electuaries, &c.

EXTRACTIVE JUICES.

These juices are furnished principally by the herbaceous parts of plants; nearly all of them are extracted from the leaves and the herbaceous stems.

All extractive juices contain:—

Vegetable albumen,
Extractive matter,
Chlorophyle.

The extractive matter exists in the juices in two different states: part of it is found in solution, another part in the insoluble state (Liebig's vegetable fibrin, Proust's gluten).

Chlorophyle is the green colouring matter of the leaves, stems, and calices of plants. Its properties are greatly analogous to those of the resins. Its colour is dark green. It is insipid and inodorous. It is softened by heat. It is combustible, but does not burn quite so vividly as the resins. It is insoluble in water, but dissolves in alcohol, ether, and the fixed and essential oils; it is also soluble in sulphuric acid and in acetic acid, and in the alkalis.

Green lackers of various shades may be obtained by adding to an alcoholic solution of chlorophyle a metallic salt, and subsequently an alkali.

The process of preparing chlorophyle is very simple:—Bruise the green leaves, &c., into a pulp, press out all the liquid, wash the pulp with water, and treat subsequently with alcohol. Evaporate the alcoholic solution, and wash the extract with a little water.

The extraction of the juice from plants is effected in the following manner:—

Remove, in the first place, any part or portion of the plant that exhibits signs of commencing alteration; take the sound parts, and wash off all dust or earth that may happen to adhere to them. Shake the washed plants vigorously in a cloth in order to remove the water (at all events, the greater part of it). Put the plants now in a marble mortar, and crush them into a pulp with a wooden pestle. Plants containing acid juices must be bruised in a wooden mortar. (In operations on a large scale the plants are usually crushed under millstones. This is done, for instance, in Switzerland to effect the extraction of the sorrel juice; in Languedoc olives are crushed in this way.)

If the plant happens to be rather deficient in juice, a little water must be added to the pulp, in order to dilute the juice sufficiently to enable it to run off. The addition of a little water to the pulp is quite indispensable, for instance, to effect the extraction of the juice of saponaria, and of most of the labiated plants.

The addition of a small portion of water (one sixteenth) is required also in the case of thick and viscous juices, such as those of borrage, bugloss, &c. In cases where the juices of such plants are expressed in conjunction with those of more succulent plants, the addition of water may be dispensed with.

Subject the pulp now to the action of the press. The juice which runs off is green and very turbid. In this state it is a compound of a solution of albumen and extractive and saline matters, holding in suspension coagulated albumen, a little gluten, chlorophyle, and the finest parts of the vegetable tissue which have been carried off mechanically by the juice.

Juices are seldom used in this state, as their turbid and slimy appearance would be sure to disgust the patient. They require accordingly clarification. Of this operation we shall speak in our next lecture.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON SUPERPHOSPHATE OF LIME.

By THORNTON J. HERAPATH, Esq.,
of Bristol.

Amongst those substances of animal origin which are employed by agriculturists as fertilizing agents the bones of man and the mammiferous animals have been long recognised as holding a prominent and highly important position. As generally used, the fat and part of the gelatine is extracted from them by boiling in water; and they are afterwards reduced to powder, more or less coarse, in a crushing-mill of a peculiar construction. Even in this state, however, which is the best they can possibly be obtained in by mere mechanical means, the bones have been found by farmers to be only partially decomposed in the soil, even after many years' exposure: this is particularly the case in strong clayey soils, the impermeable nature of which prevents a free access of air and moisture, which are the principal agents in effecting their disintegration.

To overcome this insolubility of bones, and thus to render their constituents more readily assimilable by plants, the agriculturists of this country have been lately in the habit of acting

upon them with the diluted mineral acids, generally sulphuric acid, by which means the insoluble basic phosphate of lime, which forms the basis of the bony structure, is converted into a highly soluble acid phosphate. At the same time the sulphuric acid, by combining with the liberated lime of the carbonate and part of the phosphate of lime, forms with it sulphate of lime or gypsum, a substance not only in itself highly beneficial as a manure to most crops, but also, from a peculiar property which it possesses of absorbing the free ammonia of the atmosphere, capable of furnishing a constant supply of nutriment to the young and growing plant.

It was principally for the manufacture of this substance, which goes under the names of sulphated bones or superphosphate of lime, that Mr. Lawes, of Rothamstead, Hertfordshire, took out a patent in 1842. Another patent was also obtained by Sir James Murray, about the same time, for the preparation of a somewhat similar article.

The easiest and most economical mode of preparing this manure is to pour over the finely-powdered bones about half their weight of strong sulphuric acid (oil of vitriol of commerce), sp. gr. 1.845, which has been previously diluted with from three to four times its weight of water.* The whole is then allowed to remain undisturbed for a few days, being occasionally stirred, however, with a piece of stick or an iron rod, to produce an intimate mixture, until all effervescence has ceased and the bones are reduced to a pulpy mass. In order to obtain this in a portable state, it is either dried by evaporation, or, if for home consumption, by adding a sufficiency of some dry substance, such as charcoal-powder, burnt peat, ashes, &c., capable of absorbing the redundant liquid.

Thus prepared it occurs as a light grey, somewhat coherent mass, which may be easily reduced to powder and drilled in with the seed. It is in this state that it is usually met with in commerce.

According to Mr. Lawes, good commercial superphosphate of lime ought to contain in 100 parts :—

Water	20
Organic matter	20
Phosphate and biphosphate of lime	35 to 40
Sulphate of lime	20 to 25
	100.

In order to satisfy myself that this statement was correct, I prepared some superphosphate by acting on the shankbone of an ox in fine powder with dilute sulphuric acid, as in the above-described process, and analyzed the product. The following are the results of my analyses of the superphosphate and the original bone from which it was produced :—

Bones.

Fat	0.250	31.204
Gelatine, tissues, &c.	30.954	
Phosphate of lime (tribasic)	56.752	
Phosphate of magnesia with some fluoride of calcium	3.256	
Carbonate of lime	5.321	
Carbonate of magnesia	0.121	
Carbonate of soda with some chloride of sodium and phosphate of soda	2.011	
Water and loss	1.335	
	100.000	

Superphosphate of Lime.†

Organic matters	18.761
Soluble superphosphate of lime	18.061
Phosphate of lime	9.961
Sulphate of lime	31.361
Perphosphate of iron	minute traces
Sulphate of magnesia	4.102
Sulphate of soda	1.048
Water and loss	16.706
	100.000

* Every bushel of bones requires about 22 lbs. of sulphuric acid and 70 or 80 lbs. of water.

† 100 grains of bones, with 50 grains of sulphuric acid, &c., when dried, gave 139.77 grains of superphosphate of the above composition.

The superiority of sulphated bones as a manure over bones in their normal state is now so generally admitted, even by the highest authorities, that it may be considered almost superfluous to give any of the experiments of practical men on the subject. However, as I thought it might be interesting to some of my readers, I have annexed a table of a few of their results which are to be met with in the various agricultural journals and newspapers of the day :—

Bushels of Bones per Acre.	State of Bones.	Weight of Produce per Acre. Tons.	Cwts.	Sts.	lbs.	
16	Crushed.	10	3	4	8	of bulbs, Swedes.*
2	Dissolved.	9	12	0	0	
2	Ditto.	11	15	0	0	
4	Ditto.	12	11	6	4	
8	Ditto.	16	1	3	6	
8	Ditto.	13	15	7	0	
20	Crushed.	12	4	0	3	of bulbs, mangold-wurzel.
21	Dissolved.	15	9	1	5	

From these experiments it appears that two bushels of bones per acre, dissolved in acid, would produce as beneficial effects as sixteen bushels of bones in their ordinary state; that the produce from eight bushels of dissolved bones would greatly exceed that from sixteen bushels of bones employed in any other way; and, lastly, that the greater and proportionate increase is obtained by the application of four bushels of dissolved bones per acre.

Results still more striking than the above were obtained when the superphosphate of lime was diluted with water and applied to the drills in a liquid state by means of a water-cart, as will be seen by the following table :—

Manure per Acre.	State.	Produce per Acre.	
8 bushels of bones; 83 lbs. of sulphuric acid	Dry.	11 tons of bulbs	Dale's hybrids.
2 bushels of bones; 83 lbs. of sulphuric acid	Liquid.	12 1-5 "	
9½ bushels of bones; 28 lbs. of sulphuric acid	Dry.	17 "	Swede turnips.
1¾ bushel of bones; 46 lbs. of sulphuric acid	Liquid.	17½ "	
16 bushels of bones; 46 lbs. of sulphuric acid	Dry.	13½ "	White field turnips.
3½ bushels of bones; 92 lbs. of sulphuric acid	Liquid.	16 "	

It will be observed that the above experiments were made on the different varieties of turnips and mangold-wurzel, to which description of vegetables it has been found to be more particularly applicable, as, from its highly stimulating and fertilizing properties, it not only produces more abundant crops than other manures, but it also causes the young plant to vegetate so rapidly as in a very short time to remove it out of all danger from the fly, a great desideratum in agriculture.

From the great demand which has arisen for this manure, and the high price of the materials employed in its manufacture, numerous attempts have been made by unprincipled persons to adulterate it with various other less costly articles. Amongst those generally employed for this purpose may be enumerated sawdust, sand, sulphate of lime or gypsum, and carbonate of lime or common chalk. The last of these is particularly pernicious, as, by combining with the free phosphoric acid of the superphosphate, it reconverts it into insoluble basic phosphate of lime or bone earth.

* These are principally extracted from Mr. Hannane's prize essay, for an abstract of which vide *Agricultural Gazette*, April 19, 1845.

Some samples of such adulterated superphosphate were recently sent to our laboratory for analysis by a gentleman in the west of England, who had obtained them from certain provincial agents, whose names I am sorry I am not at liberty to mention. They were found to possess the following composition :—

	I.	II.
Water	28.98	23.98
Organic matter	15.05	14.97
Soluble superphosphate of lime	6.80	7.31
Phosphate of lime	9.97	12.89
Sulphates of soda and magnesia	1.00	1.09
Sulphate of lime	34.64	35.86
Oxide of iron	..	some
Alumina	..	some
Silica and sand	3.56	3.90
	100.00	100.00

No. 1 was marked "Lawes'," No. 2 "Miller's," as being the names of the original manufacturers.

When such names as these are appended by unscrupulous men to their adulterated compounds, it behoves every person to be careful to satisfy himself of the genuineness of an article previous to purchasing it, by sending an average sample to some chemist of established reputation, who, for a moderate fee, will easily ascertain by an analysis its composition and freedom from impurities.

Another specimen which was placed in our hands for examination by a different person to the above, but to which no name was attached, was found to contain :—

Water	47.200
Organic matter	3.590
Soluble superphosphate of lime	7.010
Phosphate of lime	10.607
Phosphate of alumina	5.000
Perphosphate of iron	traces
Sulphate of lime	25.093
Silica	4.500
	100.000

The organic matter was in this case found to consist almost entirely of sawdust, with some other vegetable matter. It contained no gelatine, showing that it could not have been produced by the decomposition of bones.

Amongst the few substances which are occasionally resorted to as substitutes for bones in the preparation of this manure, native phosphorite or apatite is, perhaps, the best and most easily obtainable. Within the last few years a peculiar phosphatic earth has been also discovered in the greensand formations of the south of England, which, if it could be supplied in sufficient quantity, would bid fair to entirely supersede the use of bones. A specimen of this, which was recently sent to us for analysis, was of a light yellowish-brown colour, and slightly hygrometric. Upon a qualitative examination it was found to contain carbonic, phosphoric, sulphuric, and silicic acids, combined with lime, magnesia, alumina, and oxide of iron, with traces of organic matter, alkaline salts, oxide of manganese, and fluoride of calcium. When analyzed by the usual method (the phosphoric acid being estimated by Berthier's process as perphosphate of iron) it was found to contain as follows :—

	Per cent.
Water	3.400
Organic matters	traces
Silica and sand, with some silicate of alumina and silicate of iron	13.240
Alkaline salt	traces
Carbonate of lime	28.400
Carbonate of magnesia	traces
Sulphate of lime	0.736
Phosphate of lime	21.880
Phosphate of magnesia	traces
Perphosphate of iron	24.760

Phosphate of alumina	7.032
Fluoride of calcium	traces
Loss	0.552
	100.000

Mansion-house, Old-park, Bristol,
December 12, 1848.

A CORRESPONDENT ON THE ADULTERATION OF OATMEAL.

In my former communication to your valuable journal, on the manufacture of potato starch, I mentioned that the fibre of the potato was separated from the starch by washing on a sieve. This fibre is afterwards pressed under a hydraulic press, kiln-dried, and subsequently ground under small stones, and converted into *potato meal*. This article so closely resembles oatmeal in appearance that it is difficult to distinguish the two, and I regret to inform you that I have of my own knowledge known it bought to a very great extent by houses in the meal trade, for the purpose of adulterating that article. Of course it has no nutritious value,* and I wish to draw attention to this subject, as I believe it to be one not generally known by scientific chemists, and one not easily detected. I will, at as early a period as I can, obtain the article, and forward you a sample. As before, I wish to preserve my incognito, leaving you to use these remarks or not as you may deem desirable.

FARADAY ON THE CONNECTION BETWEEN MAGNETISM AND CRYSTALLINE FORM.

At a meeting of the Royal Society, December 8, Dr. Faraday delivered the Bakerian lecture, "On the Crystalline Polarity of Bismuth and other Bodies, and on its Relation to the Magnetic Form of Force." The author, having prepared small cylinders of bismuth by casting them in glass tubes, had so often been embarrassed by the anomalous magnetic results which they gave, that, having determined to investigate the matter closely, it ended in a reference of the effects to the crystalline condition of the bismuth, to certain general laws which may be announced as follow :—If bismuth be crystallized in the ordinary way, and then crystal, or a group of symmetric crystals, be selected and suspended in the magnetic field between horizontal poles, it immediately either points in a given direction or vibrates about that position, as a small magnetic needle would do, and, if disturbed from this position, after some time returns. On resuspending the crystal so that the horizontal line which is transverse to the magnetic axis shall become the vertical line, the crystal then points with its maximum degree of force. If it be again resuspended so that the line parallel to the magnetic axis be rendered vertical, the crystal loses all directive force. This line of direction, therefore, which tends to place itself parallel to the magnetic axis, the author calls the magne-crystallic axis of the crystal. It is perpendicular, or nearly so, to the brightest and most perfect of the four cleavage planes of the crystal. It is the same for all crystals of bismuth. Whether this magne-crystallic axis is parallel or transverse to the magnetic axis, the bismuth is in both cases repelled from a single or the stronger pole; its diamagnetic relations being in no way affected. If the crystal be broken up, or if it be fused and resolidified, and the metal then subjected to the action of the magnet, the diamagnetic phenomena remain, but the magne-crystallic results disappear, because of the confused and opposing crystalline condition of the various parts. If an ingot of bismuth be broken up and fragmentary plates selected which are crystallized uniformly throughout, these also point; the magne-crystallic axis being, as before, perpendicular to the chief plane of cleavage, and the external form, in this respect, of no consequence. The effect takes place when the crystal is surrounded by masses of bismuth, or when it is immersed in water or solution of sulphate of iron, and with as much force apparently as if nothing intervened. The position of the crystal in the magnetic field is affected by the approximation of extra magnets or of soft iron; but the author does not believe that this results from any attractive or repulsive force exerted on the bismuth, but only from the disturbance of the lines of force or resultants of magnetic action, by which they acquire as it were new forms; and, as the law of action which he gives is, that the line or axis of magne-crystallic force tends to place itself parallel, or as a tangent, to the magnetic curve or line of magnetic force, passing through the place where the crystal is situated, so the crystal changes its position with any change of direction in these lines. After noticing the magne-crystallic condition of various bodies, the lecturer proceeded to consider the nature of the magne-crystallic force. In the first place he examined closely whether a crystal of bismuth has exactly the same amount of repulsion, diamagnetic or otherwise, when presenting its magne-crystallic axis parallel or transverse to the lines of magnetic force acting on it. For this purpose the crystal is suspended either from a torsion balance, or as a pendulum thirty feet in length, but, whatever the position of the magne-crystallic axis, the amount of repulsion is the same. In other experiments a vertical axis was constructed of cocoon silk, and the body to be examined was attached at right angles to it as radius; a prismatic crystal of sulphate of iron, for instance, whose length was four times its breadth, was fixed on the axis with its length as radius and its magne-crystallic axis horizontal, and, therefore, as tangent; then, when this crystal was at rest under the torsion force of the axis, an electro-magnetic pole with a conical termination was so placed that the axial line of magnetic force should be, when exerted, oblique to both the length and the magne-crystallic axis of the crystal; and the consequence was that, when the electric current circulated round the magnet, the crystal actually receded from the magnet, under the influence of the force, which tended to place the magne-crystallic axis and the magnetic axis parallel. Employing a crystal or plate of bismuth, that body could be made to approach the magnetic pole under the influence of the magne-crystallic force; and this force is so strong as to counteract either the tendency of the magnetic body to approach or of the diamagnetic body to retreat, when it is exerted in the contrary direction. Hence the author concludes that it is neither attraction nor repulsion which causes the set or determines the final position of a magne-crystallic body. He next considers it as a force dependent upon the crystalline condition of the body, and, therefore, associated with the original molecular forces of the matter. He shows experimentally that, as the magnet can move a crystal, so also a crystal can move a magnet. Also, that heat takes away this power just before the crystal fuses, and that cooling restores it in its original direction. He next considers whether the effects are due to a force altogether original and inherent in the crystal, or whether that which appears in it is not partly induced by the magnetic and electric forces; and he concludes that the force manifested in the magnetic field, which appears by external actions and causes the motion of the mass, is chiefly, and almost entirely, induced, in a manner subject, indeed, to the crystalline force and additive to it; but at the same time exalting the force and the effects to a degree which they could not have approached without the induction. To this part of the force he applies the word magneto-crystallic, in contradistinction to magne-crystallic, which is employed to express the condition, or quality, or power which belongs essentially to the crystal. The author then remarks upon the extraordinary character of the power, which he cannot refer to polarity, and gives expression to certain considerations and views which will be best learned from the paper itself. After this, he resumes the consideration of Plucker's results "upon the repulsion of the optic axes of crystals" already referred to, and arrives at the conclusion that his results and those now described have one common origin and cause. He then considered Plucker's results in relation to those which he formerly obtained with heavy optical glass and many other bodies. In conclusion, the lecturer expatiated upon the rapidity with which the knowledge of molecular forces grows upon us, and how strikingly every investigation tends to develop more and more their importance and their extreme attraction as an object of study. A few years ago magnetism was an occult power affecting only a few bodies; now it is found to influence and to possess the most intimate relations with electricity, heat, chemical action, light, crystallization, and, through the latter, with the forces concerned in cohesion. Well may we, he remarked, in the present state of things, feel urged to continue in our labours, encouraged by the hope of bringing the study of molecular forces into a bond of union with gravity itself.

* Our correspondent is in error here.

FOREIGN SCIENTIFIC INTELLIGENCE.

BERLIN ACADEMY OF SCIENCES.

ON THE EMPLOYMENT OF SAL AMMONIAC IN CHEMISTRY. BY PROFESSOR ROSE.

[*Continued from page* 74.]

Compounds of Lead.—The oxide of lead, heated with sal ammoniac, changes into a chloride of that metal, which, by the presence of air, and successive additions of sal ammoniac, is susceptible of volatilization. The sulphate of lead, heated with chloride of ammonium, leaves a melted mass of a brownish-black colour, which is a combination of chloride and sulphate of lead, which disengages, when calcined with access of air, abundant vapours of chloride of lead, and which is, after repeated additions of sal ammoniac, susceptible of volatilization.

Oxide of Zinc volatilizes completely when mixed with sal ammoniac under the form of chloride of zinc, but always with much difficulty if out of access of air. The anhydrous sulphate of zinc rises in froth when heated with chloride of ammonium; the residue may be completely volatilized by renewing the treatment with sal ammoniac.

Oxide of Chrome and Chromates.—The salts of the protoxide of chrome suffer no change when heated with sal ammoniac; the alkaline chromates on their part have a certain quantity of oxide of chrome and of alkaline chloride of the metal which is dissolved when heated with water, whilst the oxide of chrome remains insoluble. By thus treating the alkaline chromates their analysis may be readily effected. The well-known double salt of sulphate of potass and sulphate of the oxide of chrome is changed after dehydration and heating with sal ammoniac with a mixture of oxide of chrome and chloride of potassium.

Silica.—Silicic acid gently heated loses by treatment with sal ammoniac a little of its weight; but when the heat is prolonged it acquires such a dense state as to be able to resist the action of chloride of ammonium. The crystallized and dehydrated silicate of soda is decomposed to one half of its quantity when heated with sal ammoniac.

Phosphates.—The phosphate of soda, heated with sal ammoniac, increases in weight; but the weight of the residue diminishes by new treatments with this salt: nevertheless, it is always greater than that of the phosphate employed. A partial decomposition takes place, a chloride of sodium is formed, and a small quantity of phosphoric acid driven off in the form of chloride. If the heat be prolonged after the sal ammoniac is volatilized, there is, by the influence of the phosphoric acid and the influence and humidity of the air, a portion of chlorine driven off in the form of hydrochloric acid, without any

apparent alteration, augmentation, or diminution of weight. The phosphate of lime is not decomposed when acted upon by sal ammoniac.

Combinations of Antimony.—Professor Rose had already shown that sal ammoniac expels the antimony from the alkaline antimoniates, and that the antimony can be exactly determined as a metallic chloride. By treatment with sal ammoniac we can readily analyze the combinations of the sulphurets of the alkaline metals with sulphuret of antimony, as, for instance, the salt of Schlippe, composed of sulphurets of sodium and antimony. This salt, after its treatment by sal ammoniac, becomes a pure chloride of sodium, completely deprived of all traces of sulphur and antimony.

Arseniates.—The alkaline arseniates are very readily transformed by sal ammoniac into alkaline chlorides of the metals, as M. Rose has already shown. The arseniate of lime thus leaves, after having been heated, a chloride of sodium; but it is not so with arseniate of magnesia, which undergoes no change from the sal ammoniac. It appears that it may be completely decomposed by means of sulphate of ammonia, but this ammoniacal salt is not convenient for quantitative analysis, because it melts when exposed to heat, and froths up in such a manner as to render it difficult to prevent a portion of the mass rising over the crucible.

Borates.—Borax undergoes no change when heated with sal ammoniac, which is volatilized by the heat before the borax begins to melt.

Metallic Fluorides.—The fluoride of sodium is decomposed, but with difficulty, when heated with sal ammoniac. The fused chloride of sodium preserves the fluoride which is not yet decomposed from the action of the sal ammoniac. The fluoride of calcium is still more difficult of decomposition.

Metallic Bromides.—The bromide of sodium is not totally decomposed when heated with chloride of ammonium. The residue obtained, after several successive treatments, consists in the most part of chloride of sodium, but it always contains considerable quantities of bromide.

Metallic Iodides.—The iodide of potassium is not completely changed by the action of sal ammoniac into chloride of potassium, even after a repetition of the treatment.

Nitrates.—The nitrate of potash is easily and completely decomposed by chloride of ammonium, and gives a quantity of chloride of potassium corresponding with the salt employed.

THE SALE OF POISONOUS DRUGS IN FRANCE.

The French Legislature had at all times subjected the commerce of what is called poisonous substances to certain restrictive measures, adopted for the interest and safety of the public health. An ordinance of October 29, 1846, modifying the previous state, gave rise to lively reclamations on the part of chemists and others; so that M. Flocon, when Minister of State, thought proper to consult the Academy of Medicine before taking any decisive step. He at the same time enjoined their making the inquiry as secret as possible, so as not to divulge any dangerous notions to the public at large. The School of Pharmacy of Paris, together with a consulting committee, presented to the Minister a new list, containing only a very small number of the poisonous substances comprised in the table which was annexed to the ordinance of October 29, 1846.

In order to appreciate the motives of this ordinance, and the value of the modifications proposed to be added, it is necessary to observe that prior to this ordinance the whole legislation on poisons was contained in the articles 34 and 35 of the law of 21 Germinal. By the first it was enjoined "that poisonous substances—particularly arsenic, realgar, and corrosive sublimate—shall be kept by chemists and druggists in safe and separated places, of which they should have the key, so as to enable no other individual to dispose of the drugs." These substances could only be sold to persons well known and domiciled, and who might want them in the pursuit of their profession, or for some known object. The transgressor was visited with a fine of 3,000 francs.

By Article 35, the apothecaries and druggists were enjoined to keep a register, numbered and paragraphed by the mayor or the commissary of police, wherein those who should buy poisonous substances of them were at once to inscribe, without leaving any blank, their name, qualification, and residence; the nature and quantity of the drugs delivered to them, and the use which they intended to make of them; together with the date of the purchase. Whoever acted against it was likewise visited with a fine of 3,000 francs. Where the individuals buying poisonous drugs were unable to write, but known to be persons in want of them, the apothecaries and druggists were bound to make the entry themselves.

However, in spite of all these rigorous measures, numerous cases, within the last twenty years, of poisoning occurred, proving thereby that society was not sufficiently protected by the existing laws against the sale of poisons for unlawful purposes. The Legislature, on the proposition of the Minister of Agriculture and Manufacture on the 19th of July, 1845, passed, therefore, a law, according to which those who act contrary to the royal ordinance referring to the public administration, sale, purchase, and use of poisonous substances, had to pay a fine of from 100 to 3,000 francs, and were to be imprisoned for six days to two months. The goods seized could be confiscated. The Articles 34 and 35 of the law of 21 Germinal were repealed.

As may be seen, the law of July 19 graduated the penalty settled by Art. 35, and thus far advantageously modified the law of 21 Germinal; but as regards the rest it referred to the ordinance which was further to regulate the sale of poisonous drugs.

The first observation to be made on this ordinance, and to which the attention of the Academy was principally called, was, that in the adopted system all poisonous substances were classed in two sorts—the one comprising a part of the table annexed to the ordinance; the other containing substances the sale of which was free to all the world. Among the latter, which were subject to no restriction whatever, were found sulphuric acid, muriatic acid, nitric acid, acetate of copper, acetate of lead, ammonia, white lead, caustic potassa, &c. &c. It was by no means by any oversight that these latter substances had not been referred to in the table of poisonous drugs, but they were on purpose separated from them on account of their daily application in art and industry, and from the impossibility which existed of executing the prescribed measures of precaution.

As for those substances reported by the law to be poisons, the ordinance has established two facts:—

1. The whole sale of poisonous drugs for any purposes other than medicinal would be carried on by any person under certain conditions, which latter principally consisted in a declaration made to the authority, and in the obligation of making a full entry in the register.

2. The sale of the same drugs for medical purposes (by pharmaciens) could only take place on the production of an order from a medical man, in which order the dose, and the mode of administration, were to be distinctly indicated. The ordinance compelled the apothecary to copy the formula in a register kept particularly for the purpose of enabling him to meet any inquiry on the part of the authority, within a period of twenty years; also to keep these drugs at a safe and separated place under lock and key. The substances to which these measures were applicable constituted the table annexed to the ordinance of October 27. This table included seventy-six drugs, which, with their immediate compositions, formed a total of at least two hundred substances, and among them many which are most frequently used, as opium, laudanum, tartar emetic, the salts of mercury, kermes, iodide of potassium, &c.

In comparing the poisonous substances comprised in this table, with those which do not make part of it, the question arose whether it be really necessary to subject the sale of so great a number of substances, many of which are little or not at all poisonous, to such rigorous restrictions; whilst, on the other side, it must be admitted that the most dangerous poison must escape all surveillance. The water of Rabel (sulphuric alcohol) and that of Codex (a mixture of alcohol and sulphuric acid) were classed among the poisonous substances, whilst sulphuric acid itself was excluded from them. Carbonate of copper and ammonia were included, although they are little in use, and almost unknown to the public, whilst verdigris, sulphate of copper, and sulphate of zinc were allowed to be freely sold. Others, as kermes, iodide of potassium, of sulphuret, of gold, of antimony, &c. &c., enumerated in the table, have hardly ever been used for the purpose of poisoning.

The question, therefore, arose whether the precautions had in view by the ordinance were really obtained,—and whether the impediments thrown in the way of the free action of pharmaciens did afford a sufficient recompensation to society at large.

It was evident that the obligation of keeping about 200 medicines at a place separated, and locked, compelled the pharmaceutist to have a second shop; and as the latter included medicines like laudanum, emetics, &c., it would be neither less visited nor contain a less number of drugs than the one which contained no poisonous matter. The dispenser cannot possibly be expected to deliver all the medicines personally, and would be obliged to entrust the key to those under him. The inconveniences resulting from this arrangement were almost equal to those which were intended to be avoided; and it was, therefore, considered preferable to adhere to the arrangement enjoined by Art. 34 of the law of 21 Germinal. The measures, it is true, are rigorous, but they are effectual, and offer to society a real guarantee against the sale of poisons either from ignorance or for criminal purposes. They are also very practicable, because they include only a small number of drugs, and these little in use. Arsenic, corrosive sublimate, realgar, do not belong to those medicines which are used as such in a druggist's shop, nor is their immediate action of such a nature as not to allow some delay in their delivery if the chemist should be absent at the moment. But, if the question comes to apply this rule to all substances included in the table of 29th of October, it becomes almost equal to a prohibition of pharmaceutical business. It appeared, therefore, indispensable to reduce the number of drugs included, and the only question was which drugs were to be omitted.

The Society of Pharmacy of Paris, in a memoir to the Minister of Agriculture and Commerce, made a distinction between poisonous substances with the view to a preventive measure. Arsenic and sulphuric acid are, in a physiological and medical point of view, two poisons equally violent and equally dangerous; their criminal application constitutes the crime of poisoning as defined by the penal code, and visited by the same punishment. But if we consider their criminal administration with a view to prosecution, and also the difficulties which the law meets in the endeavour of bringing the act of poisoning home to its real author, we shall find that both poisons differ immensely. Arsenic is a substance which, from its colour and its form as powder, may be mixed with a multitude of substances used as food or spice; it may cause death by a very small dose; it may be furtively introduced, and in fatal doses, in all kinds of food, without its victim becoming aware of it, and without the least manifestation of its presence either by taste or any other characteristic sign. Moreover, accidents of a lighter kind produced by arsenic are extremely similar to symptoms produced by indisposition; and, even in a case where its application is followed by

death, the symptoms of poisoning, whatever their intensity may be, never have any absolute value, and do never allow us to conclude that there has been a real case of poisoning.

Instead of laying hold of the culprit, it is better to arm the hand of justice with all means of opposing the perpetration of a crime which it finds itself incapable of discovering after its consummation.

It is not so with sulphuric acid; this is a substance of excessive taste, and causes atrocious and intolerable pain, even by doses much inferior to those which are followed by death. It, therefore, cannot be administered in a poisonous dose without the individual who takes it obtaining knowledge of it; his attention being awakened, he is roused to resistance and desperate struggle. Finally, this acid leaves in the body, in the mouth, on the whole body, and on the articles of dress, such deep traces, and of such a nature, as could only have been imitated by cutting instruments or firearms.

The law will then have no difficulty in proving the criminal act; the difficulty is also greatly obviated by public clamour; even those who are strangers to the medical art, and the most ignorant persons, will not approach such a victim without at once recognising the traces of the caustic substance. There need, therefore, be no apprehension in this case, as there is in that of arsenical poisoning, that the silence of the tomb may protect the culpable person against the severity of the law; and society will not be exposed, as is only too often seen, to await from fortuitous circumstances the discovery of a crime committed unperceived.

What has been said of sulphuric acid is alike applicable, only in a different degree, to nitric acid, to potassa,—in one word, to all substances of a caustic nature, or which are of an acrid, repugnant taste, when taken even in small doses.

From this difference between arsenic and sulphuric acid it is evident that the measures of safety indispensable for the first are not necessary in the same degree for the latter; and it is also clear that the modifications of the Legislature have almost an exclusive bearing upon arsenic only.

We all have still in recollection those melancholy cases of poisoning which threw terror into society, and recalled minute details on the properties and the effects of arsenic. Science has been at war with itself; it left the public to appreciate the value of the means of tracing the poison; it discussed before the tribunals, in the journals, and in separate pamphlets, all the chances which by these means were left to the criminal to withdraw himself from the verdict of guilt. It is consequently not to be wondered at that lawyers, magistrates, and the whole community should have been roused and should by an unanimous voice have asked for preventive measures, in order to protect society more effectually against the effects of a substance as dangerous, and often employed, as it is difficult to trace.

It was on the force of these circumstances, and, as already said, with reference to arsenic alone, that a modification of the law of poisons was considered necessary. The practice of pharmacy had been uselessly fettered, whilst, on the other hand, all precaution was abandoned with regard to other substances, otherwise dangerous, but the daily use of which repelled the execution of those minute restrictions to which arsenic alone should have been subjected. The inconsistency was the more felt as all the minute precautions referred only to chemists, whose known watchfulness already sufficiently protects society, whilst druggists, merchants in colours, grocers, &c. &c., were disengaged from all responsibility, although they were known to heap together the most different articles, and to sell simultaneously poisons and articles of food: starch and white lead, potash, soda with seasalt, oxalic acid and sugar-candy, salt of lead and the green o Sweinfurt, baryta, sugar, starch, and vermicelli, could there be seen together on the same counter.

The mere reduction of the number of poisonous articles in the table of the ordinance would not sufficiently protect society, and the Academy, therefore, in addition, recommended the continuation of the *visits* prescribed by Article 29 of the law of 21 Germinal and the Article 42 of 25 Thermidor.

These visits made by the schools of pharmacy and medical juries have for their principal object the inquiry of remedial drugs, spices, alimentary and all other substances the adulteration of which might exercise an injurious influence upon the public health. The same visits were to be extended to those poisonous substances which were not included in the table. This measure at once reconciled the freedom of commerce with the guarantees claimed by society; it is more especially *preventive;* and the persons charged with the execution of it have it in their power to impart most useful instruction to small traders, to remind them of their duties and the responsibility and the danger they incur in selling poisonous articles indiscriminately. Order and care, so essential in preventing accidents, are strictly maintained by these inspections, and a great many misfortunes and crimes thus prevented without any noise or show.

From statistical statements made to the Minister of Justice it appears that in the department of the Seine, which comprises a population double or triple to that of most other departments, and in which nineteen twentieth parts of the arsenic existing in France are found, the number of cases of poison is below that observed in the greatest number of departments. Of 335 crimes committed by poison during a period of six years, 4 only belonged to the department of the Seine, whilst 8 were proved to have occurred in the department le Puy de Dôme, 9 in the Haute Garonne, 10 in Maine and Loire, 12 in the Gers, 13 in the Isère. So striking a difference observed in the capital, in the presence of so many elements favourable to crime, and with such facilities to commit them, can only be ascribed to the daily surveillance, incessant and well-understood, and to the fear which is imparted by it, and not less to the instruction and light given it on this important part of commerce to all classes of society interested in it. Many cases of poisoning have thus been prevented at grocers and confectioners' shops, and many adulterations of food withheld from the poor.

TABLE OF POISONOUS SUBSTANCES PROPOSED BY THE SCHOOL OF PHARMACY AS A SUBSTITUTE OF THAT ANNEXED TO THE ORDINANCE OF 29TH OF OCTOBER.

Hydrocyanic acid.
Poisonous alkaloids and their salts.
Arsenic and its compositions.
Belladonna extract and tincture.
Cantharides (entire).
Conium—extract and tincture.
Cyanide of mercury.
Cyanide of potassium.
Digitalis—extract and tincture.
Emetic tartar.
Hyoscyamus—extract and tincture.
Nicotiana.
Opium and its extract.
Phosphorus.
Secale cornutum.
Stramonium—extract and tincture.
Corrosive sublimate.
Chloroform.

—*Journal de Pharmacie et de Chimie, par M. Charles Gerhardt.*

GINGER WINE.—Take 7 gallons of water, add to it 8 pounds of lump sugar, 2 ounces of good Jamaica ginger, pare and cut one dozen lemons, and the whites of four eggs, boil a full hour and skim, and, when the syrup has boiled enough, let the whole stand still till about milk-warm or less; then squeeze them out, strain, and put into a tub with a little yeast; work three days, put into a cask, with a little isinglass to fine it, and let it stand three months, when it will be fit for use. In a fortnight it will be ready for bottling.

REVIEWS.

BOWMAN'S PRACTICAL CHEMISTRY.

[*Continued from page* 76.]

The author, well keeping in view the idea of a practical book, omits all mention of imponderable chemistry, and the discussion of those general laws which he assumes to have already learned from previous lectures or systematic treatises on the science.

All systematic division of chemical agents into their inorganized classes the author discards, but introduces them one by one on the stage in the manner most likely to develop the resources of the young chemical aspirant. The introductory chapter is devoted to the exposition of the principles of the gas-holder, the preparation of hydrogen, of carbonic acid, binoxide of nitrogen, olefiant gas, carbonic oxide, and oxygen. With reference to the preparation of the latter gas Mr. Bowman mentions a process to the benefit of which, in yielding a pure and abundant stream of oxygen gas, we can testify, commonly employing it ourselves. Although so valuable, strangely enough it is not very generally mentioned by authors on chemistry. It consists in the distillation of a mixture of black oxide of manganese with chlorate of potash, 20 grains to 100 grains, in a Florence flask.

The preparation of oxygen gas from pure chlorate of potash requires a very high temperature for glass vessels to stand; and the oxide of manganese to yield oxygen by mere distillation requires a cumbrous iron apparatus. As to the production of oxygen from a mixture of oil of vitriol and oxide of manganese mixed, the process is all but worthless. There is none, in fact, so convenient for general use as the plan described by the author. By easy stages the learner is carried to progress through a scheme of well-devised laboratory instruction up to the highest walk of chemical science, the ever-fertile field of analysis, which he thus introduces:—

"PRELIMINARY EXAMINATION, &c.

"522. When a substance is presented for examination, with a view to ascertaining its chemical composition, it is obvious that it would be extremely tedious if we were to begin by applying indiscriminately the tests for the various metals and acids, until we happened to meet with one which gave a characteristic reaction; and although such a method might occasionally succeed in the examination of substances consisting merely of one base and acid, it would certainly be found wholly inefficient under less favourable circumstances, as when two or more bases and acids are mixed together, which would mask or neutralize each other's behaviour with the different reagents employed. Hence the necessity of a well-devised plan of proceeding, in which, by means of a few simple experiments, we are enabled to obtain some considerable insight into the nature of the substance under examination.

"523. Before beginning what may be called the real analysis of a substance it is generally advisable to make a few preliminary experiments upon it, in order to ascertain the class of compounds to which it belongs, and whether the usual mode of analysis will be likely to succeed with it; this may be called the preliminary examination.

"We will first suppose that a solid substance has been given to the student for examination. If it is a liquid he may pass on to (533).

"SECTION I.

"*Preliminary Examination of Solids.*

"524. Observe whether the substance is crystalline or amorphous: whether it is homogeneous throughout, or composed of different ingredients, such as can be distinguished either with the naked eye or with the assistance of a lens.

"Note any peculiarity of form or colour; and observe whether or not it possesses metallic lustre.

"525. Take its specific gravity (145). A knowledge of this is frequently of great service,

especially in the case of minerals, when, by a reference to a table of specific gravities, we are able at once to guess what it is, and to strike out of the list of possibilities a large number of substances which it might more or less resemble in external appearance.

"526. Place a fragment of the substance in a small tube of hard German glass, closed at one end: heat it first over a lamp, and afterwards in the flame of the blowpipe. Observe (*a*) whether it appears to undergo any change: if it does not, we infer that the substance contains no water or organic matter; that it is not readily fusible; and that no volatile substances are present.

(*b*) Does it fuse? and if so, does it continue fluid as long as the heat is applied, or does it, after a short time, solidify while still in a heated state? If it solidifies while hot, it had probably undergone what is called the watery fusion, or melted in its water of crystallization, which is gradually expelled, condensing in the upper part of the tube. If the substance fuses without any other apparent change, it probably contains either an alkali or an alkaline earth.

"(*c*) Does it wholly volatilize? If it does, of course no fixed matter is present, and we are thus enabled to lessen the circle of our inquiry very considerably.

"(*d*) Perhaps a portion volatilizes, leaving a fixed residue: hence we infer that the substance under examination is probably a mixture of two or more substances.

"(*e*) When the substance is volatile (either wholly or in part), observe whether the vapour condenses in the cool part of the tube; and if so, whether the matter deposited is solid (crystalline or amorphous) or liquid: if the latter, is it neutral or otherwise to test paper? Is the vapour combustible? Has it any characteristic smell, as of ammonia, or of burning sulphur, or of arsenic (301)?

"(*f*) Does the substance under examination blacken when heated? If it does, we may infer that some organic matter is present; and if, by continuing the heat with access of air on a piece of platinum foil, the blackness disappears, we may pronounce with certainty that such is the case. If the burnt mass when cold effervesces on being moistened with dilute hydrochloric acid (*HCl*), while the substance in its original state does not, we may infer that an organic acid was present, which when heated is converted into carbonic acid, forming a carbonate (462, 471). In this case, too, it is highly probable that the base with which the organic acid was in combination is either an alkali (potash or soda) or an alkaline earth (lime, magnesia, baryta, or strontia), as otherwise the newly-formed carbonate would probably have been decomposed, leaving either a metallic oxide or reduced metal (423).

"(*g*) In case of carbonization, observe whether any characteristic smell is given off during the decomposition (470, 480), and also whether the vapour which is formed is neutral, acid, or alkaline to test paper: if alkaline, it is probable either that ammonia was present, or that nitrogen was contained in the organic matter.

"It is not to be considered certain that, because a substance does not char when heated, no organic matter is present, since many organic substances volatilize without decomposition.

"527. Heat a fragment of the substance on charcoal in the inner flame of the blowpipe. In this experiment some of the appearances already obtained by heating in a tube will probably be repeated, such as charring, volatilization, &c. Observe,

"(*a*) Whether the substance fuses, either easily or only after prolonged application of the flame. If fusion takes place speedily, and especially if the fused mass is absorbed by the charcoal, it is probable that potash or soda is present: if the former, the flame may be tinged with a violet colour (187).

"(*b*) If the substance fuses and boils, and after a short time solidifies while still under the influence of the heat, the fusion was probably owing to the presence of water of crystallization (526 *b*).

"(*c*) If the substance is infusible (either without, or subsequent to, the watery fusion), and remains on the charcoal in the form of a colourless infusible mass, the substance is probably an alkaline earth, silica, oxide of zinc, or alumina. If an alkaline earth, it will probably radiate an intense white light while ignited. The white infusible mass may then be moistened with a solution of nitrate of cobalt and again heated, when, if it becomes blue, alumina may be suspected (245); if green, oxide of zinc (261); and if pale pink, magnesia (209). If it is silica, it will fuse into a clear colourless bead with carbonate of soda, effervescing at the same time (427).

"(*d*) In case a bead of reduced metal, or a coloured infusible residue, is formed on the charcoal, it should be mixed with carbonate of soda (NaO, CO_2), and again heated as before on charcoal in the deoxidizing flame. If tin, copper, silver, or gold are present, a bead of the metal will be formed without any incrustation on the charcoal. If iron, cobalt, or nickel are present, they will be reduced to the metallic state, but instead of fusing into a bead will be mixed up with the carbonate of soda (being infusible except at a high temperature), giving the bead a grey opaque appearance.

"(*e*) If a white deposit is formed on the charcoal round the bead of metal (or, indeed, without any metallic bead), it is probably owing to the presence of zinc or antimony. If zinc, the oxide while hot is yellowish, becoming white on cooling (260).

"(*f*) If a yellow or brown deposit is formed, either lead, bismuth, or cadmium may be supposed to be present.

"528. Warm a fragment of the substance in a tube with strong sulphuric acid (HO, SO_3).

"(*a*) If effervescence occurs, it is probably owing to the escape of some volatile acid which is displaced by the sulphuric acid. If the gas thus liberated has no smell, carbonic acid may be suspected (419). If it smells of hydrosulphuric acid, the substance was probably a sulphide (438), in which case sulphurous acid (SO_2) would at the same time be formed. If the smell resembles that of nitric or nitrous acids, the presence of a nitrate may be inferred, especially if orange-coloured fumes are evolved on the addition of clean copper filings (448). If the disengaged gas is greenish-yellow, with a smell somewhat resembling chlorine, it is probably owing to the presence of a chlorate (457).

"(*b*) If organic matter is present (which will have been already ascertained (526 *f*)), the escape of gas may be due to the carbonic acid or other gas formed by the action of the sulphuric acid upon it; and consequently the presence of a volatile acid is not proved by this experiment when organic matter is present.

"(*c*) If the substance undergoes no apparent change by the action of sulphuric acid, the absence of all these compounds may be inferred.

"529. The next point to be ascertained in the preliminary examination is as to the solubility of the substance in water and other solvents. Place five or ten grains of the pounded substance in a test-tube, and treat it with a little distilled water (at first cold, and afterwards boiled if the substance does not dissolve), and observe whether it is wholly or partially soluble, or whether it is absolutely insoluble. This is known by evaporating a drop of the clear liquid (filtered if necessary) on platinum foil, when, if anything is dissolved, it will be left as a residue; which, if abundant, indicates that the substance is copiously soluble; and if slight, that it is only sparingly so.

"(*a*) If nothing is dissolved by the water, we thus prove the absence of all soluble compounds.

"(*b*) If it wholly dissolves, we prove the absence of all insoluble compounds.

"(*c*) If it partially dissolves, it is either a sparingly soluble substance, or a mixture of soluble and insoluble matters; the addition of more water will show which of these is the case. If it is a mixture, the insoluble portion may be separated by filtration from the solution, for further examination (530).

"530. If the substance, or any portion of it, is found to be insoluble, or but very sparingly soluble in water, it must be treated with dilute hydrochloric acid (*HCl*) (except it be a metal, sec 531), and if necessary boiled. Whether or not anything dissolves may be ascertained by evaporating a drop of the clear liquid on platinum foil (529). If effervescence occurs, it is probably owing to the escape of a gaseous acid, which may sometimes be identified by the smell or colour (528 *a*). If the smell of chlorine be given off, it may be owing to the presence of a peroxide, as of manganese (MnO_2).

$$MnO_2 + 2HCl = MnCl + 2HO + Cl.$$

"In case the whole, or any portion, of the substance prove insoluble in hydrochloric acid, it must be separated by filtration, and retained for further examination (532).

"531. If the substance is a metal (known by its metallic lustre, &c.), it must be treated with strong nitric acid, and, if necessary, boiled.

"(*a*) If no apparent action takes place, the metal is probably gold or platinum; and, if it be found that nothing has dissolved, the absence of all the common, easily-oxidizable metals may be inferred.

"(*b*) If the metal is acted upon, and a white precipitate is at the same time formed, which is found to be insoluble in water, it is probable that antimony or tin is present (391); and if, besides the formation of the white precipitate, some of the metal is dissolved (known by evaporating a drop of the clear liquid on platinum foil), the presence of some other metal, soluble in nitric acid, may be relied on.

"(*c*) If the metal dissolves entirely, the absence of gold, antimony, and tin may be inferred.

"532. The matter (if any) which proved insoluble in hydrochloric acid (530) is now treated, first with strong nitric acid, and then, if it resists solution, with nitrohydrochloric acid (727), and if necessary boiled. If insoluble in this, it is probably one of the insoluble silicates, sulphates, or chlorides, and will have to be afterwards examined (578, 623).

"SECTION II.

"*Preliminary Examination of Liquids.*

"533. When the substance given for examination is liquid, a drop or two should be evaporated on platinum foil to ascertain whether or not it contains any fixed matter in solution. If such is the case, a small quantity of the liquid is to be evaporated to dryness in a basin, and the residue examined according to the directions given above for solid substances (524, 526 et seq.). Towards the end of the evaporation, when the residue is nearly dry, and a pellicle of solid matter is formed on the surface, it is very liable to spurt, and project small portions of the substance out of the basin (644); this is best avoided by moderating the heat, and by constantly stirring with a glass rod, so as to prevent the formation of the pellicle.

"While the evaporation is going on, the following experiments may be commenced with the solution.

"534. Take its specific gravity (148).

"535. Test the solution with litmus and turmeric paper, to ascertain whether it is neutral or otherwise.

"(*a*) If neutral, the absence of free acids and alkalis, and of acid salts, may of course be considered certain. It is probable, also, that the only salts present are those of the alkalis or alkaline earths, as the solutions of most other salts have a feebly acid reaction.

"(*b*) If it has an acid reaction (known by its reddening blue litmus paper) it is owing to the presence of either an uncombined acid, an acid salt, or a soluble salt of one of the heavy metals, many of which have a feebly acid reaction. To ascertain which of these is present, pour a little of the solution into a test-tube, and stir it with

a glass rod, the end of which is moistened with a solution of carbonate of potash (KO,CO_2+2Aq); if this causes a precipitate, the acid reaction is probably owing to the presence of a metallic salt; while, if the solution remains clear, a free acid or an acid salt is probably the cause.

"(*c*) If the solution has an alkaline reaction (known by its turning turmeric paper brown), it is probably owing to the presence of a free alkali or alkaline earth, one of the alkaline carbonates, or an alkaline sulphide. In this case we are enabled to exclude at once all oxides which are insoluble in alkaline solutions; and, if alkaline carbonates are present, none of the alkaline earths can exist in solution, since they would be thrown down as insoluble carbonates.

"535. If the solvent liquid is supposed, from its taste or smell, to be other than water, it may be necessary to insulate it from the solid matter it contains, for examination. This is best done, if the liquid is volatile, by distillation in a small retort (61), or, if the quantity of liquid is minute, the distillation may be effected in two small tubes. The distilled liquid may then be examined as to its taste, smell, specific gravity, boiling point, &c.

"537. When the substance to be examined is liquid, containing solid matter in suspension, the latter is to be separated by filtration, and the solid and liquid portions examined separately, according to the directions given (524 et seq. and 533 et seq.)"

THE CHEMICAL TIMES.

SATURDAY, DECEMBER 23, 1848.

OUR OWN SERIES.

No. IV.

ON CHEMICAL MANIPULATION.

Glass-cutting.

A very large proportion of the glass apparatus employed by chemists should be home made, and often extemporaneously. The facilities, therefore, which are conferred by a ready means of cutting, bending, and blowing glass are great indeed.

Glass tubes, from which the chemist fashions his apparatus, are, as we have already remarked, of various kinds, both as to size and quality. In this place, as regards the means of working them into shape, we may divide tubes under the two heads of hard and soft. To the former belong the Bohemian potash glass without lead, the English window and black bottle glasses. To the second head belong English flint glass tubes, which derive their softness from containing lead. Tubing, both hard and soft, should be kept on stock in the laboratory, each presenting its own peculiar advantages and disadvantages, which will be subjects of comment hereafter. The beginner in glass-working manipulation should commence his labours on the latter kind, as being, all things considered, most easy of management.

The first thing to be learned is the art of cutting tubing into determinate lengths, an operation for which a file is the instrument best adapted. For the purpose of trying the first experiment the operator should select a piece of tube of moderate thickness, and somewhat larger than the stem of a clay tobacco-pipe. The files to be employed are of the kind known as the *best Lancashire*, as being considerably harder than any other. Their shape should be triangular, and their length about four inches.

A file of this kind will be found to scratch soft glass tubes readily; and, if new and sharp, hard white Bohemian or green English tubing without much difficulty.

The tube to be cut should be laid flat on the table, or but slightly raised from the latter, and caused to revolve against one corner of the file held in the right hand. By this treatment a scratch will be made around the tube, ending where it set out, and thus forming an even ring. Some little practice is necessary to impart a knowledge of the degree of force with which the tube is to be pressed against the file. The amount of force it is difficult to explain by mere language. Perhaps the term *tenderly*, as used by artists to indicate a peculiarity of touch, is the word best adapted to convey the desired impression. As a general rule it may be affirmed that the learner will commence by applying more than proper force. He will commence the operation under the influence of an idea derived from the filing of metal, and will only learn by practice how materially the two cases differ.

The act of cutting a metal bar or tube in two pieces by filing is an act of bodily removal of particles, and the time occupied in cutting will be proportioned to the amount of pressure and velocity imparted to the filing operation. Not so the cutting of glass by a file, in which case the object is to set up a series of vibrative shocks occasioned by the successive blows of the teeth of a file, such a molecular disturbance between the particles of glass in a certain direction, that either a crack appears visible to the eye, or else without the appearance of such a crack the tube may be broken like a notched stick.

Having succeeded in effecting a slight scratch round the tube operated upon, the file should no longer be held motionless, but should be moved forwards and back across one side of the tube with great velocity, little power being exerted. By this means the glass will be thrown into such a state of vibration that frequently a crack is immediately formed. Whether this latter occur or not, matters little in the case of a tube of the size which we are supposing the learner to operate upon. He may simply push the tube over the table's edge until the latter corresponds with the scratched ring, the portion not filed being uppermost,—and employ force as if he were breaking a stick, when the two pieces will readily separate.

With smaller tubes the easiest touch of a good file is sufficient to effect the necessary degree of cohesive disruption. With larger ones the case is more difficult, and involves a greater amount of care. Indeed, if the tube exceed the diameter of half an inch, it is usually desirable not to trust to the file alone for cutting it, but (having produced a scratch ring, and subsequently a crack, by means of the file) to lead this crack completely round the tube by means of a red-hot wire. For this purpose an iron knitting-needle, protected by paper or rag at the handle extremity, is very good. Being made red hot in the fire, and passed in succession along every portion of the scratched ring, commencing at the end of the crack, the latter, if the operation be dextrously performed, will be sure to follow, without any appreciable deflection. In this manner not only may *tubes* be cut, but curved pieces of glass in general, such as jars, flasks, &c.

So useful are the numerous pieces of apparatus which this ready means of cutting enables the chemist to make, that it is hard to say when a glass vessel of capacity is sufficiently broken to be of no further value. The frequent and ingenious manipulator will cut and recut it again and again, making out of its débris the most useful and various pieces of apparatus.

Generally this glass-cutting operation will be called into requisition on broken flasks and retorts, both of which may be transformed into evaporating capsules of great utility; and the necks of retorts, being melted at the larger end, and slightly expanded, make very excellent little matrases for effecting digestion, or, if bent, they become retorts again.

The best kind of glass vessel, perhaps, on which to acquire a facility of cutting by the combined agency of the file and heat is a Florence flask, which may be procured at so cheap a rate that the operation of cutting may be performed without any compunction. And here, in connection with the very thin glass ware, we will point out to the inexperienced operator a very successful way of testing the file, which consists, not in using it as a file at all, but more as a pen. If the extremity of a good file be broken off, a small surface is thrown open, bounded by three sharply cutting points: of these, one generally may be found capable of scratching glass so readily that it is not difficult to write on this material in characters clear, flowing, and well-defined; whilst the degree of pressure necessary to be exercised is very small indeed. This latter is a great advantage in some glass-cutting operations. In the cutting of a thin glass bulb, for example, such as that of a Florence flask, on which the amount of pressure necessary to make a file scratch in the ordinary manner, would often rupture the vessel by forcing in its wall.

The young operator, after he has become expert in the cutting of glass tubes, may exercise his ingenuity in the same direction by cutting Florence flasks into evaporating dishes of various curves. Not only may the flask be cut across the middle, thus converting the upper section into a funnel, and the lower one into an evaporating capsule, but by the exercise of a little greater amount of address the section may be effected in such a manner that the expanding portion of the neck of the flask, where it merges into the bulb, may be fashioned into a very convenient lip. In this case it is evident the evaporating capsule will be shallow and oval, instead of deep and round. When a thick piece of the latter has been cut, it is sometimes necessary to grind each end smooth. This is accomplished by means of rubbing each end made wet with a file, and here we have a true filing operation, similar to the filing of a metal bar or tube.

Larger glass vessels of cylindrical form, such as bottles and jars, do not admit in general of having their cut and rough edges made smooth and even by the file; a better plan consists in

grinding the ends on a flat surface with a little silver sand or emery and water.

THE LATE MYSTERIOUS SUICIDE OF A DRUGGIST'S ASSISTANT.

It is surely a most unusual contingency, that at this time, and in this metropolis, the task should devolve upon us, alone, of commenting upon, nay, of even announcing to the public ear, the occurrence of a case of self-poisoning under circumstances which render the secrecy in which it has been held a matter of no little suspicion.

Notwithstanding the prevalence of the crime of poisoning in England for several years—the public has not yet been so accustomed to these matters that a case of self-murder, occurring in the west of London, should, under the ordinary working of circumstances, furnish no matter for comment in the daily journals of the metropolitan press. Yet such a case has occurred, and the journals have been silent, for which silence rumour is not slow to find a cause.

The circumstances of the case, we understand, are these:—The principal assistant in the firm of one of the fashionable dispensing druggists of this metropolis had been guilty of irregular entries into the day-book of his principal:—Entries which led to the suspicion that a misappropriation of money had, from time to time, been effected. With the view of determining this question, the assistant was called to account: his answers not being satisfactory, the son of the principal immediately proceeded to the young man's securities, to bring the case before them. To this mission the principal himself was averse, but the son persisted. On his return the assistant was dead: he had taken nearly an ounce of hydrocyanic acid!

Thus far we do not challenge any one portion of the demeanour of the principal. He had strong grounds for entertaining a suspicion, and the sad result leaves its own inference. Our challenge is in another direction,—involving the question why the whole matter was veiled in such imperturbable secrecy? In the absence of the open intelligence to which the public has a right in all cases of serious import like the one before us, we are under the necessity of publishing a rumour, one which seems, however, to come before us in a most consistent shape.

It is asserted that the unfortunate suicide in question—a married man, and a father of many children—had been, up to a certain period, in the receipt of a salary usual to gentlemen filling the responsible position of first dispenser in a large metropolitan establishment—a salary of £250 per annum. At this period, in an evil hour, some difference occurred between the principal and himself, which led to his receiving notice to leave. To the assistant, a man with wife and family, this prospect of leaving shadowed forth such scenes of penury and distress that he determined to make a most abject apology rather than subject himself to this fate. The apology was made—(so goes the tale) and accepted, but with the cruel stipulation that the future salary should be cut down to £60!

We trust, for the sake of humanity, this statement is not true,—that the publicity which we have given to it will lead to such a disclaimer from a responsible source, as shall silence the injurious rumour at once. Whatever be the true explanation of the mystery in which the case has been veiled, the principal of the firm in question will, if the true spirit of our remarks be properly appreciated, owe us a meed of thanks for thus enabling him to correct a statement which, far from passing current in a few obscure cliques of his own circle, was the theme of speculation—nay, of adverse comment, at the metropolitan head-quarters of pharmacy—the Pharmaceutical Society, at their last réunion.

True or false, the rumour prompts us to comment on a subject of painful notoriety, involving the misery, we may say the destitution, of thousands of deserving young men—nay, young is a designation far too limited to embrace the painful fact. Men of all ages, gentlemen always by education, oftener by other claims,—from the youth of sixteen, brimful of hope, of energy, of enthusiasm, to whom the future is an El Dorado, a bright Atlantis teem-with unreal things—to the quondam principal of an establishment in earlier days:—gentlemen from boyhood almost to the verge of old age, we are sorry to say, may be found occupying the position of druggists or surgeons' assistant; and what is their pay?. Will the general public credit the monstrous-looking assertion, that such gentlemen,—men whose duties involve not less a responsibility than the guardianship of human life,—whose position requires the maintenance of a gentlemanly exterior,—whose avocations render this a matter of greater than ordinary expense, receive, in many cases, a paltry stipend of £15 a year? Yet such is the fact, as thousands of gentlemen could at this moment testify. Surely a state of bondage like this is too crying an injustice to be much longer borne without universal and public remonstrance. This remonstrance, however, should emanate from the assistants themselves; who, instead of frittering away their indignation by solitary plaints or useless individual wailings, should unite in a body for the purpose of representing to the medical and pharmaceutical professions the systematic and dangerous injustice to which, as a body, the assistants have too long been exposed. "Aide toi et Dieu t'aidera" should be their motto. From their own remonstrance alone,—powerful, though temperate, decisive, though not factious,—will any amelioration be achieved.

BOTANICAL SOCIETY OF LONDON.

Wednesday, Nov. 29, 1848.—Twelfth Anniversary Meeting.—John Edward Gray, Esq., F.R.S., &c., President, in the chair.

Donations of British plants were announced from Dr. Wood, Rev. W. W. Newbould, Mr. F. Brent, Mrs. Atkins, Mrs. Bodenham, Mr. J. D. Salmon, Mr. J. Tatham, jun., Mr. T. Sansom, and Miss M. Beevor.

The Secretary read the annual report of the council, from which it appeared that twenty-three new members had been elected since the last anniversary. The distribution of specimens to the members had given the greatest satisfaction, and many valuable specimens had been received from members and other botanists for distribution during the ensuing season.

The report was unanimously adopted, after which a ballot took place for the council for the ensuing year, when the chairman was re-elected president, and he nominated J. Miers, Esq., F.R.S., and E. Doubleday, Esq., F.L.S., vice-presidents.

Dr. Cooke and J. W. Rogers, Esq., were elected new members of the council, in the room of J. Coppin, Esq., M.A., and Dr. Parkin, who retire in rotation.

Mr. J. Reynolds and Mr. G. E. Dennes, F.L.S., were respectively re-elected treasurer and secretary.

Mr. T. Moore was elected librarian.

LIVERPOOL COLLEGE OF CHEMISTRY.

We publish in another part of our journal an extract from a Liverpool paper, in which it is stated that Dr. Muspratt anticipates the consent of the London College of Surgeons for conferring on the Liverpool College the right of giving chemical certificates recognised by the London surgical board.

That the London College will fully recognise it at once we have no doubt whatever. Dr. Muspratt's testimonials and well-known chemical acquirements will carry their due weight. Whilst making this remark we beg leave to say that the London College of Surgeons displays, on most occasions, a liberal, enlightened, gentlemanly spirit, which might well be emulated by many other kindred boards.

The Liverpool College of Chemistry is conducted on the plan of the London establishment, and recognises the imparting of laboratory knowledge as its primary aim. According to the old routine, as is well known, lectures were considered to be of first importance; indeed, practical chemistry remained a thing unknown until introduced as a necessary part of medical education by the London Apothecaries' Company, who deserve great praise for their exertions in this direction.

In the Liverpool College of Chemistry a working place is appropriated to each student, who provides himself with the smaller apparatus, and filtering paper. The larger implements, tests or reagents, gas, fuel, and other materials, are supplied by the professor, who is present from ten till five o'clock every day during the session. Each student proceeds by himself in a series of experiments, which make him acquainted with the reactions—*id est*, the chemical properties of all the more commonly occurring bodies. When perfectly familiar with these phenomena, he is taught, by a systematic course of experiments, all necessary manipulations and processes, by making analysis of a variety of substances, so prepared by the professor as to lead from the simple to the more complex cases. When expert in qualitative he enters upon a course of quantitative analysis. More advanced students engage in original research.

Such a school—a school similar to Liebig's at Giessen, or to the Royal College of Chemistry in London—has never yet been established in Liverpool. The students at Giessen devote their whole attention to obtaining purely scientific principles. They endeavour to solve purely scientific problems; and thus acquire the power of elucidating all questions relating to the arts, when a reference to chemistry becomes desirable. This process, although much scouted by those who affect to call themselves purely practical men, is the one after all which is most within the legitimate scope of the chemist, and which best enables him to be of real use in developing the arts and manufactures. Once conversant with chemical science as a whole, he can master any portion in detail; and an explanation of the following remark of the illustrious Liebig is readily found:—"I am acquainted," says he, "with many of my former pupils, who are now at the head of every variety of chemical manufactures, without having practised them in the laboratory. On being introduced to a manufactory, they very soon became perfectly familiar with the processes employed by the manufacturer, and speedily produced a number of well-advised improvements."

In this country very little attention has hitherto been paid to the study of chemistry;

but the time is not far distant when every great town must possess a school for analytical instruction. Popular lectures on chemistry are very useful, in their way, but they serve only to give a taste for science; they never teach it. It can only be taught in schools where the student has to work with head and hands, under the eye of a professor. We daily witness in every town, district, and village, the need of skilful scientific chemists, capable of aiding the physician, the agriculturist, the manufacturer, and the miner; and of discovering in the arts new uses for substances which a benevolent Providence has distributed everywhere for the benefit of mankind—nothing being created in vain. Nowhere is the estimation in which the acquirement of chemical knowledge ought to be held by men of every class more fully exhibited than in the Royal College of Chemistry, where may be seen gentlemen of all classes, all professions, working side by side.

In appealing to the influential gentlemen connected with a town which so largely contributes its assistance to the advancement of the arts as Liverpool, Dr. Muspratt feels assured that they will second with their valuable influence his attempt to establish there a chemical school, the more particularly as he has studied his profession with the most distinguished chemists in Europe, and, subsequently, acted as honorary assistant professor in the Royal College in London. We wish Dr. Muspratt all the success he deserves.

THE CHOLERA.

CASES REPORTED UP TO DEC. 20.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON DEC. 19, 1848 :—				
In London and vicinity, viz. :—				
Whitechapel	7			
Bromley St. Leonard's	1			
Islington	1	1		
Wandsworth	..	1		
In the country, viz. :—				
Liverpool	7	6		
In Scotland, viz. :—				
Edinburgh	17	11	9	
Glasgow	79	26	4	
Maxwelltown	18	8	11	
Clossburn	1			
Total new cases	131	53	24	—
In London and vicinity	487	254	100	133
In the country	241	125	32	84
In Scotland	1820	821	314	685
Total	2548	1200	446	902

BILLS OF MORTALITY.

According to the Registrar-General's return the total number of deaths registered in London during the week ending Saturday, December 16, from all causes, was 1,130, being 24 below the weekly average for the five years ending 1847. Of the 1,130 persons whose deaths are registered in London, 579 were males and 551 females; 500 were under 15 years of age, 351 between 15 and 60, and 188 were 60 years or upwards (the age of one person whose death is ascribed to atrophy not being stated); 24 persons died from the smallpox, 20 from the measles, 113 from the scarlatina (of whom 111 were under 15 years of age), 45 from hooping-cough (all under 15 years), 24 from diarrhœa, 29 from the cholera (13 being under 25 years, 15 between 13 and 60 years, and one 60 years or upwards), 68 from typhus, 23 from dropsy, 20 from cancer, 87 from consumption (79 being between 15 and 60 years), 34 from hydrocephalus (32 being under 15 years), 20 from apoplexy, 44 from convulsions (42 being under 15 years), 37 from disease of the heart (only one being under 15 years), 79 from bronchitis (43 being under 15 years, 11 between 15 and 60, and 25 being 60 years or upwards), 86 from pneumonia, &c.

The births of males registered in the week amounted to 718, and of females to 679—total 1,397.

The following fatal cases of cholera were registered in the week ending Saturday, December 16. Seven were cases in which inquests were held; the remainder are all certified by medical attendants :—

CHELSEA; South.—F. 30, "malignant cholera, 84 hours."

WESTMINSTER; St. John.—Prisoner in the Millbank Prison, M. 56, "Asiatic cholera, about 14 hours," p.m.—Inquest. Prisoner in the same institution, M. 63, "Asiatic cholera, about 14 hours."—Inquest. Prisoner in the same institution, M. 27, "Asiatic cholera, about 8 hours." Inquest.

ISLINGTON; West.—F. 21, "malignant cholera, 16 hours."—Inquest.

WEST LONDON; North.—In St. Bartholomew's Hospital, F. 12, "cholera."

BETHNAL-GREEN; Church.—In Garden-place, Hope-town, on December 1, M. 7, sudden death from cholera (12 hours).—Inquest. In the same family, on December 3, F. 5, "sudden death from cholera (3 days)."—Inquest. The above two cases are not yet registered. Mr. Reynolds states that "the place in which they occurred, as indeed the whole of his district, is low, confined, swampy, and without drainage. Garden-place is far from being the worst in the neighbourhood. Subsequently to the deaths the houses have been thoroughly cleansed, and the cesspools emptied. The present state of weather, and the want of sewerage, begin to produce fever of all kinds in the district."—Hackney-road.—M. 3, "English cholera (7 days)."

WHITECHAPEL; Mile-end New-town.—In Christchurch workhouse, M. 50, "malignant cholera (18 hours)." In same workhouse, M. 15, "cholera (4 days), congestion of brain (1 day)." In same workhouse, M. 5, "cholera (60 hours." In same workhouse, M. 13, "contagious malignant cholera (4 days)." Goodman's Fields.—At 21, White Bear-court, Lambeth-street, M. 15, "Asiatic cholera, collapse (3 days), consecutive fever (8 days), ulceration of the cornea of the left eye on the ninth day, total blindness and deafness on the morning of the tenth. He died on the eleventh day of the illness."—Aldgate.—M. 36, "Asiatic cholera (10 hours);" F. 5, "cholera (18 hours)."

ST. GEORGE'S-IN-THE-EAST; St. Mary.—M. 35, "natural death, sudden, from cholera (15 hours)."—Inquest.

STEPNEY; Limehouse.—M. 42, "diarrhœa (1 week), Asiatic cholera (12 hours)." Shadwell and Wapping.—M. 5, "Asiatic cholera (3 days)." — Mile-end Old-town (Lower). — In Mile-end workhouse, coal-whipper, 35, "cholera (5 days)." Mr. Castleden states that "the deceased was very intemperate, and was brought into the workhouse in almost the last stage of thedisease."

POPLAR; Poplar.—F. 1, "English cholera." Bow.—M. 14, "cholera; fever (14 days)." "The parents of the boy reside in a very dirty neighbourhood, adjoining a felt factory at Old Ford, Bow."—Mr. Dunstan's note.

ST. OLAVE; St. John.—M. 24, "Asiatic cholera (72 hours)."

GREENWICH; East. — F. 45, "spasmodic cholera (3 days)." Mr. Waller states that "this case occurred in one of the tenements at the back of Spring-gardens, which he considers a very unwholesome neighbourhood, being low, damp, and without drainage. Opposite the house (which consists of two rooms, one over the other, without back ventilation) there is a privy for general use. The deceased had been reduced to great debility by attendance on her son, a lad of 21 years, who died on the 11th of typhus fever, after an illness of seven weeks. The whole family were in very poor circumstances." West.—In Dreadnought Hospital, M. 18, "cholera," p.m.

WANDSWORTH, &c.; Wandsworth. — M. 6, "cholera (3 days), convulsions (7 hours)." Clapham.—M. 3 months, "diarrhœa (44 hours), cholera (24 hours)." Battersea.—At the union workhouse, labourer, 33, "Asiatic cholera (12 hours)." At Stewart's-buildings, daughter of a milkman, 4, "cholera (12 hours)."

Mr. Hems, the registrar of Whitechapel Church sub-district, states that "a case of cholera has occurred in his district during the week." On the 10th an inquest was held; particulars have not yet been received.

Mr. Verrall, the registrar of St. John's, in St. George-in-the-East, states that "since he made the last entry in this week's report he has received information from the coroner of an inquest held on a young man aged 19 years, a labourer, who died on the 13th instant from cholera (24 hours), p.m., at St. George's workhouse."

GENERAL RULES TO BE FOLLOWED IN QUALITATIVE ANALYSIS.*

We shall speak here of the qualitative analysis of the solid inorganic substances only. The course to be adopted for that of gaseous bodies will be indicated further on.

It is always difficult for a beginner to determine upon what quantity of the substance to be qualitatively analyzed he should operate. It is not advisable, even when the substance to be analyzed is plentiful, to operate upon too large a quantity, though the operation is thereby greatly facilitated, since it is then possible to take different portions of that substance for the purpose of determining the various constituent principles, which cannot be done when only a small quantity of it can be disposed of. At all events, the analyst must never experiment upon the whole of the substance, but should always reserve part of it, except in case of absolute necessity. This precaution should never be neglected, even when the quantity of the substance to be examined is very small. The most convenient quantity for a beginner to operate upon is two or three grammes (from 30 to 50 grains), when there is plenty of the substance.

Whether the substance to be examined is in abundant or in small quantity it is always advisable to take a very small portion of it for the purpose of ascertaining whether it is composed of inorganic substances only, or whether, on the contrary, it does not contain some organic matter. This may be ascertained in various ways, but the best for the beginner is the following:—If the substance be in powder, take a small portion of it with the point of a knife, or if in compact masses break off a few grains of it, and introduce these portions in a white glass tube, closed at one end, of about two inches in length, and three or four eighths of an inch in diameter. The closed end of this tube may be slightly blown, but very slightly, as the glass must not be too thin at that point. The closed end containing the substance to be tested is then heated in the flame of a small spirit-lamp, during which operation the tube must be held up at a moderate angle, but not in a perpendicular nor a horizontal position. Most organic substances become black by exposure to heat when the air is not freely admitted, and at the same time, and in most cases, though not always, the ordinary products of the distillation of organic substances are formed, namely, empyreumatic oil and water. There are, however, cases which do not exhibit these phenomena, although organic matter is present; but the number of such cases is very limited, and, when the organic substance is of a volatile nature, it may be completely evaporated without turning black

* From Normandy's Translation of Rose's Chemistry.

by charring, and this may happen even though the organic matter be mixed or combined with fixed inorganic substances. Yet the presence of a fixed inorganic matter often determines the carbonization of the volatile organic element. Such is the case, for example, with the organic acids, which in the free state, and when they contain water, may be completely volatilized without decomposition, but which, when combined with fixed inorganic bases, are decomposed, and charred by exposure to heat.

When the substance contains an organic body, the operator may at the same time ascertain whether it contains nitrogen. This may be done by holding a strip of reddened litmus paper, previously moistened, at the orifice of the glass tube, and at a sufficient distance of the heated point, in order to prevent its being destroyed by the heat. If the organic substance contains any nitrogen, however little, it will yield ammonia, which will turn the strip of reddened paper blue. If the proportion of nitrogen be considerable, a white cloud is produced by holding a glass rod moistened with muriatic acid at the orifice of the tube.

When the substance contains no organic matter, the above experiment may also indicate whether it contains any water, or other volatile matter. If water be present, it condenses into drops on the cold sides of the heated tube. If a narrow strip of litmus paper be now introduced in the tube, so as to make it touch the condensed water, the operator may see whether it has an alkaline or an acid reaction. An alkaline reaction of the water indicates in some cases the presence of ammonia, but it may be due also to the substance under examination, which may be susceptible of an alkaline reaction, and which may have been mechanically thrown up in the upper part of the tube.

The application of heat alone may thus volatilize not only the water, but also the ammoniacal salts contained in the substance in question. Amongst the ammoniacal salts a few only are not thus decomposed, but in that case a white sublimate is produced, which deposits in the colder parts of the glass tube; in most cases, however, a temperature much higher than that at which the water volatilizes is required to produce this white precipitate. The presence of ammonia in the sublimate is very easily detected.

Heat volatilizes also the salts which contain mercury, amongst which perchloride and subchloride of mercury are the only ones which are not thus decomposed. In most cases the mercury of such salts is reduced, and is deposited in the metallic state in the colder portions of the tube.

Various other substances are volatilized by heat, either in the gaseous, or in the liquid, or solid state; such is the case with the volatile acids, sulphur, some metallic sulphurets, selenium, and some metallic seleniurets; certain volatile oxides; and lastly, mercury, and some other volatile metals.

The analyst who can manage the blowpipe may perform these experiments upon much smaller quantities. Small glass tubes are used for the purpose, of a very small diameter, closed at one end, and in which the substance may be heated by the flame of alcohol urged by the blowpipe. A temperature may thus be obtained much more intense than even by heating larger quantities in large tubes in the flame of a spirit-lamp with circular wick. The presence of organic substances may be detected by the same reactions as have been indicated just above; but that of volatile substances is at the same time much more readily discovered, especially those which require a high temperature for their volatilization.

When the object of the analysis is merely to know whether the substance under examination is of an organic nature, or whether it contains any organic matter, the following summary process is frequently resorted to, which consists in heating it before the blowpipe upon a charcoal support, or even upon a platinum foil in the flame of the spirit-lamp. In most cases the method answers perfectly well, but, except the operator be well used to it, it is less commodious for the purpose of detecting small quantities of organic matter.

When, however, the object in view is to ascertain whether an organic substance contains any fixed inorganic constituents, the easiest and most convenient way is to heat a small quantity of it upon platinum foil by means of the spirit-lamp, or of the blowpipe, until it is entirely carbonized, and then to burn the carbon completely off by means of the intense heat of the flame of the blowpipe playing upon that portion of the foil on which the carbonized mass rests. One may thus easily discover very small portions of inorganic matter in very large quantities of organic substances, the inorganic matters remaining in the state of ashes. Yet the incineration of the carbonized mass often requires care, because a great number of inorganic bodies, which are generally looked upon as fixed bodies, may be volatilized by a strong heat in contact with the air; such are, for example, chloride of potassium, of sodium, of lead, and a few other chlorides. If the substance in question contain easily reducible metallic oxides, it often happens that the platinum foil is strongly attacked by the reduced metal. In such cases small plates of mica may be used. Certain organic substances, especially those containing nitrogen, readily fuse under the first impression of heat, and yield a charcoal which it is difficult to incinerate, but which, however, may ultimately be ignited upon a foil of platinum by means of the blowpipe.

Inorganic substances are often materially altered by exposure to heat, and it may even happen that they will turn black or blackish because they accidentally contain organic substances, or through other reasons. But when, as a counter-proof, a small quantity of the organic substance is heated in the same way, the phenomena are so manifestly different in most cases, that it is very rare that the presence or absence of organic matter as an essential constituent of the substance in question can remain a matter of doubt. Should, however, such a circumstance present itself, the operator should fuse a little nitrate of potash in a porcelain crucible, and a small portion of the substance under trial is to be projected into the fused salt. All the organic substances, almost without exception, deflagrate when thrown into fused nitre, but not exclusively so, the same effect being produced by the combustible inorganic substances, for example, sulphur, the metallic sulphurets, a few metals, and certain metalloids in a state of extreme division. Yet the property of turning black by heat and of deflagrating when thrown in fused nitre is not met with simultaneously in any but an organic substance.

The means of determining the nature of the organic substance, after its existence has been demonstrated as above, does not form part of the plan of this work. Nor is the analytical chemistry of organic substances sufficiently advanced to enable me to do it in this manual; but when the combination under examination contains inorganic and organic substances they may be determined, especially if the former be of a fixed nature.

The presence of organic substances, especially of those which in the pure state cannot be volatilized by heat without undergoing decomposition, modifies in various ways the behaviour of a great number of reagents towards inorganic substances. I have shown in the first part of this volume, in reference to the inorganic oxides, what are the changes which the presence of organic bodies produces in the phenomena resulting from their contact with the reagents, and, if I beg to call the reader's attention again to this fact, it is because the presence of organic substances prevents many oxides from being precipitated from the solutions by alkalis by which they would otherwise be completely precipitated. Even when, which is very often the case with a great number of oxides, the presence of an organic substance does not prevent their detection and precipitation, it is, nevertheless, very inconvenient in many other respects in qualitative analysis. Many organic substances, for example, sugar, gum, and the like, render the filtering of liquids and the separation of the precipitates produced by the reagents an extremely tedious and difficult operation. Very often also their presence renders it impossible to collect on a filter the metallic sulphurets which sulphuretted hydrogen and hydrosulphuret of ammonia may have produced in solutions of metallic oxides. Frequently these substances remain for a very long time in suspension without subsiding. The same is the case with the precipitates of sulphate of baryta, sulphate of lead, &c. The presence of some non-volatile organic acids, for example, tartaric acid, may render it difficult to collect on a filter recently-precipitated metallic sulphurets, though much less than is the case with sugar, gum, and other organic substances.

The best thing to be done in most cases, for the purpose of finding the constituent principles of an inorganic body mixed or combined with organic substances, is to destroy the latter. The easiest way of effecting this, in most cases, is by ignition; and the best way of doing it consists in heating a small quantity of the substance in a small platinum crucible, by means of the flame of a spirit-lamp with circular wick. The crucible should be placed obliquely, with the cover so placed as to close only about three fourths of the mouth of the crucible. The access of the air into the crucible is facilitated by putting a thin strip of sheet iron in the uncovered part of the crucible, and stirring the red-hot substance from time to time with a platinum wire.

If the substance under examination contains metallic oxides reducible by charcoal, the combustion of the organic matter should not take place in a platinum crucible, because it would thereby be completely spoiled. The operation should then take place in a porcelain crucible, which is sometimes more difficult, because it is impossible to heat such a vessel to the requisite temperature by means of a spirit-lamp.

When the experiment takes place with large quantities a hessian crucible may often be employed, and the heat applied by means of a charcoal fire. When the substance contains oxides which are easily reducible, the organic substance may frequently be oxidized by means of nitric acid or aqua regia, which, however, gives rise to the production of other substances, the presence of which is quite as troublesome. This effect does not take place when the organic substance is oxidized by means of nitrate of potash, which on that account should often be preferred to nitric acid or aqua regia; it is only necessary to act with circumspection, and not to deflagrate too large portions of nitre at a time. It is best, therefore, to mix the substance to be oxidized with pulverized nitre, to fuse only small quantities of the mixture at a time in a porcelain crucible upon the flame of the spirit-lamp, and to add a fresh quantity only after the complete oxidization of the preceding one. Of course, in the subsequent examination of the substance which has been submitted to this treatment, regard must be had to the potash, carbonic acid, and a greater or less quantity of nitric and nitrous acids, which have thus been introduced.

MISCELLANEA.

General Remarks on Opium.—It is procured by planting the young poppies in rows about six inches asunder; and at first watering them abundantly. When six or eight inches high, they are richly manured, and again watered abundantly as they are about to flower. When the capsules or seed-vessels are about half grown, the collection of the opium commences, by making in each, at sunset, two or three longitudinal incisions, taking care not to penetrate through to the cavity where the seed is lodged. Through these incisions the juice flows, and as it concretes it is removed, and put into earthen pots, being afterwards dried in the sun. It is then formed

into balls or cakes, and wrapped up in poppy or tobacco leaves, and again further dried. Turkey opium, which is the best, is imported in flat eakes of a solid form, with fragments of leaves, and the reddish seeds of some sort of dock adhering to it. Its solution is not disturbed by that of the acetate of baryta, or of oxalic acid, and eonsequently it contains no sulphate of lime. The inferior sorts have none of the reddish seeds adhering to them. East Indian opium is in rounded masses of a darker colour, and more smooth and soft texture, with a burnt smell, and a less bitter but more nauseous taste. It is wholly soluble in water, and, therefore, contains no gluten. It gives a precipitate with oxalie acid, and with acetate of baryta, and, therefore, contains sulphate of lime. It eontains one third less morphia than Turkey opium, and is, therefore, so mueh weaker. English opium has lately been partially cultivated; and externally it is like the East Indian, but lighter in colour, though in quality it is said to equal the Turkish. This, however, would seem to depend very much on the seasons. For an account of its eulture see "Edinb. Phil. Journ.," ii., 262; and "Brande's Journ.," ix., 69. There is little ehance of succeeding of making its cultivation very extensive or luerative in England. Genuine opium smells heavy and nareotic, has a very disagreeable bitter taste, with a warmish and subacrid after-taste. It is of a deep rich fawn or brown eolour, of a tough and plastic eonsistency, and of a smooth uniform texture, marking paper with an interrupted streak. It has a speeific gravity of 1.336, whieh is one of the best tests of its purity, as few vegetable products are so heavy, if we exeept gum arabie and opoponax. Bad opium wants the peeuliar narcotie odour or smell of empyreuma: is friable or soft, full of dark brown or black patches, or is all of a deep black, marks with a eontinuous brown streak, tinges water yellow, easily melts when exposed to heat, and tastes sweetish. Adulterated so very extensively, that little opium, altogether genuine, is to be found, as the high priee is an irresistible temptation to fraud. Pieces of lead and small stones are often found imbedded in the best opium to increase the weight; and all sorts of extracts and substances, the least likely to be deteeted, are mixed with it, from the extract of poppies, or of liquoriee, to the dung of sheep and oxen. Extracts of belladonna, hemlock, and other narcotics, are sometimes added, but more commonly aloes, gum arabic, or tragaeanth; or extract of celandine and lettuee. Chemically, opium contains six alkalis, namely, codeia, morphia, narceine, nareotina, paramorphia, and pseudomorphia; the second in combination with meeonic acid, in the form of meconate of morphia, and meeonin, whieh is neutral. Besides these, it contains a sort of gum, gluten, bassorin, volatile oil, potash, along with a little sulphate of lime, caoutehouc, and always more or less impurity; frequently as much as one fourth, or one third. Soluble in water, ether, and alcohol; but much more so in vinegar, lemon-juice, or any of the vegetable acids in solution; on which latter prineiple it is that the black drop, the liquor opii sedativus of Battley, Rousseau's drops, &c., are prepared. Medieinally, opium ranks high as a nareotic, sedative, and anodyne; but it usually aets first as a stimulant, and the sedative and narcotic effects are apparently the consequent collapse of the system, as the sequela of excitement. Some maintain that it acts direetly as a sedative, without the intervention of excitement. It decreases the secretion of most of the glands, sueh as the kidneys, the parotids, the liver, and it produees constipation of the bowels, and sometimes diminishes, though at other times it inereases, the cutaneous perspiration. When it excites, the first feelings are heat of the body, thirst, absence of mind, and sometimes headaehe and vertigo; afterwards exhilaration of mind, removal of pain, ending in drowsiness and sleep, which is usually disturbed with painful dreams. On awaking, nausea, languor, and feverishness, often sueceed. It is also a powerful antispasmodic and astringent. In the East and on the Continent it is reputed to be one of the best aphrodisiacs. When frequently taken the effects diminish, and the dose, in such cases, must be increased to produce the desired effeet. It is likewise a powerful eorrigent of other medicines. Opium is contra-indieated where there is much inflammation, or a tendeney to it, as in hard, dry cough; and in the diathesis ealled bilious it seldom agrees, probably because there is a tendency to hepatitis. There are many individuals, also, who cannot bear opium, from some peculiarity of constitution. In diminished glandular seeretion, also, such as in obstructions of the liver, or kidneys, costiveness, and thirst, opium is seldom eligible. Young children ought not to take it, unless in great emergencies. Opium is preseribed in small doses as an excitant in typhus, and atonie and gangrenous states of the system; and to diminish secretion in diabetes, diarrhœa, menorrhagia, sanious ulcers, &c.; and at the period of weaning, to stop the milk in the breasts. In larger doses to allay pain and nervous irritability, whenever it can be done without the danger of producing or increasing inflammation, as in chronie rheumatism, nervous pains, gout, gravel, stone, careinoma, malignant fungus, aneurism, fever, intermittents, &e.; attending to the eautions above, and particularly to the state of the bowels. In eoughs it is invaluable, when judiciously managed, and in all spasmodie disorders, sueh as ehorea, hysteria, tetanus, &c.; it is the most powerful drug known. It is for this reason that it is so useful in asthma, cholera, hiccough, vomiting, hooping-cough, pyrosis, &e., which are partly spasmodic. Dose, $\frac{1}{4}$ grain to $\frac{1}{2}$ grain, when preseribed as a stimulant; from 1 grain to 4 grains when given as an anodyne; and even this dose may be exceeded in cases of hemorrhage, and when it is employed as an antispasmodic. When the system becomes eallous to ordinary doses, it ought to be diseontinued for a time, till the sensibility to its influence is restored. This is particularly necessary to be attended to when it beeomes a daily necessary in incurable and painful disorders, sueh as carcinoma, tic douloureux, stone, &c. Some opium-eaters have taken doses of 3 drachms. When combined with other medicines the powers of opium are often wonderfully inereased or rendered more useful, so much so, indeed, as to be available in almost every disease in some of its stages. Mercury, for example, is prevented by opium from passing off by the bowels; and when opium is eombined with ipecaeuan or antimonials the effeets are direeted almost entirely to the skin, as in the case of Dover's powder, one of the best sudorifies known. Combined with vegetable aeids, sueh as the eitric acid, the sedative powers of opium are greatly inereased, and its more disagreeable effeets greatly obviated. Overdoses of opium, when not going the length of serious alarm, may be eombated at first by bitters, such as infusion of eamomile or wormwood, in moderate doses; or, what is still better, strong coffee infused, not boiled. Vinegar and vegetable acids have been recommended, but it appears that these are improper at first, though useful in the after treatment. When sleep or drowsiness is protraeted so as to cause alarm, exeiting the system by hot brandy and water and affusion of cold water will be proper. Externally, opium is sometimes said to be advantageously applied in form of ointment or liniment; as over the stomach to allay vomiting or spasm; along the spine in convulsions, &c.; but it is not to be trusted to alone. In form of enema or suppository it is often powerful in dysentery and diarrhœa; in form of a watery injection in spasmodic stricture, gonorrhœa, leueorrhœa, &c. Applied to a hollow tooth, it sometimes eases toothache. It may also sometimes give relief to painful sores, sueh as open cancer, malignant fungus, irritable stumps after amputation, &c. In large doses opium produces giddiness, drowsiness, stupor, and afterwards delirium, paleness of the countenance, cold sweats, deep breathing, convulsions, apoplexy, and death.

Treatment for Poisoning by Opium.—Evacuate the stomach as soon as possible, by means of the stomach-pump, or an emetie of sulphate of copper or zine, in the dose of 10 grains dissolved in 1 ounee of warm water, and repeated, if necessary, in twenty minutes. If the emetics will not operate, affusion of cold water will sometimes quicken their operation. When the stomach has been evacuated, if the drowsiness continue, strong coffee, vinegar and water, hot brandy and water, ether, bleeding from the jugular vein, and the cold affusion, or the warm bath, will be proper, followed by tonics and purgatives.

Liverpool College of Chemistry.—We are glad to see that the medical profession in the town appreciate fully the local and seientifie advantages of having a college of chemistry, presided over by a eompetent professor, in Liverpool. The following memorial has been sent from this town to the Royal College of Surgeons of England. This memorial, we believe, has the entire approbation of Sir Benjamin Brodie, and other eminent surgeons:—

"*To the President and Counеil of the Royal College of Surgeons of England.*

"Gentlemen,—We, the undersigned, medical practitioners, beg leave most respectfully to request that your honourable board will be pleased to receive the certificates of attendanee from the College of Chemistry recently established here by Dr. Sheridan Muspratt. We presume it will be unneeessary to dilate upon the very great advantages that will aeerue to the medical pupils of this town and neighbourhood from having the privilege of studying chemistry under so accomplished a teacher as Dr. Muspratt, a gentleman whose claims to distinetion, as one of the first chemists of the age, have been attested, not only by Baron Liebig, but by all the other eminent ehemists of Europe. With great respeet we are, gentlemen, your most obedient servants,

"David Macrorie, M.D.
Richard Formby, M.D.
Robert Bickersteth, F.R.C.S.E.
Arnold J. Knight, M.D.
John M. Banner, F.R.C.S.E.
R. Wakefield Scott, M.D.
Henry Stubbs, F.R.C.S.E.
Hugh Neile, M.R.C.S.E.
John Cameron, M.D.
J. L. Minshull, M.R.C.S.E.
John Edwards, M.D.
Samuel M'Culloch, M.R.C.S.E.
Thomas A. Ashcroft, M.D.
W. H. Bainbrigge, F.R.C.S.E.
Henry Anderton, M.R.C.S.E.
James Turnbull, M.D.
Ellis Jones, M.R.C.S.E.
Joseph Churton, M.R.C.S.E.
P. Macintyre, M.D.
George M. Davis, M.R.C.S.E.
James Petrie, M.D.
Thomas O'Dwyer, M.D.
Francis Archer, M.R.C.S.E.
James Collins, M.D.
John Atcherley, M.R.C.S.E.
Alfred Higginson, M.R.C.S.E."

—*Liverpool Paper.*

The Supply of Water to the Metropolis.—On Wednesday night a public meeting was held at the Western Literary and Scientific Institution, Leicester-square, "to take into consideration the necessity of obtaining a cheaper, purer, and more abundant supply of water for the metropolis." Mr. A. W. Hoggins was called to the chair. He said that every one must be aware that an abundant supply of pure water was absolutely essential to the comfort and health of the population; but that that was not attainable under the present defective system had been abundantly proved. It was stated in a very able pamphlet on the subject that under the surface of London there was water to be had in sufficient quantity to supply 20,000,000 of persons at a much cheaper price than the rates imposed by the existing water companies. Taking the whole of the metropolis, the average

charge was £1 10s. 1½d. per house, but it was proved that a more abundant supply of purer water could be had at one sixth of the present charge. The agitation of the question, he had no doubt, would lead eventually to practical and substantial advantage. Intimately connected as this matter was with the great question of sanitary reform, he felt assured that the Government and the Legislature must speedily interfere, an abundant and continuous supply of pure water at a cheap rate being indispensable to public health. The following resolutions were moved and carried :—"That the supply of water to the metropolis is bad in quality, excessively dear, and very scarce, especially in the dwellings of the poor. That the present intermittent and low-pressure method is productive of much social degradation, and prevents the labouring classes from maintaining a proper degree of cleanliness, and that a vast amount of disease is thus produced. That the want of an ample supply of water for the purposes of flushing the public sewers and private drains is greatly felt; and that it is the opinion of this meeting that the Legislature should take immediate steps to remedy these evils. That water should be unlimited in quantity, and be given for the mere cost of its conveyance. That the Government should be empowered to purchase the interests of the existing companies, in order to embody the works in one great institution directly responsible to the public ; and that it is the opinion of this meeting such means would ensure to the public a pure and ample supply, with an immediate reduction of the rates, and would ultimately altogether abolish them." Thanks were voted to the chairman, and the meeting separated.

Experiments with a New Shell in Woolwich Marshes. — Colonel Dundas, C.B., inspector of artillery, and Lieutenant-Colonel Chalmers, assistant director-general of artillery, attended in the marshes at two o'clock p.m. on Wednesday to witness experiments with a new description of 32-pounder shell, submitted by Captain Thistle, of the American army, who was also present. Captain Thistle's shell is formed very similar in shape to a sugarloaf, only rather more tapering at the point, into which a nipple is inserted, and grooves are made along the cone nearly its entire length, in a slightly curved form, which caused the shell apparently, when fired, to go forward in a straight direction like an arrow, instead of revolving in the same manner as the common circular shells. The first round fired was from a 32-pounder gun charged with 4lb. of powder and one of Captain Thistle's shells, and its range, when it struck the ground, was about 550 yards. The second round was fired from an 8-inch gun with a charge of 4lb. of powder and one of the usual 8-inch shells of the service, weighing about 56lb., and its range, when it fell, was found to be 850 yards. The third round was fired from the 32-pounder gun with 4lb. of powder and one of Captain Thistle's shells, and its range was ascertained to be 950 yards. The fourth round was fired from the 8-inch gun, with the same weight of charge, and 56-pounder shell, and ranged 875 yards. The fifth round was from the 32-pounder gun, with the same weight of powder as the first and third rounds, and one of Captain Thistle's shells, and its range was about 550 yards. The sixth round from the 8-inch gun, with 4lb. of powder, and 56-pounder shell, ranged 875 yards. Captain Thistle did not appear at all satisfied with the firing of his shells, declaring that, with 4lb. of powder, when he tried them in America they never ranged less than 950 yards. The captain, previous to the seventh round being fired, ran up to the ammunition-boxes and took the next charge with which the 32-pounder was supplied from the box whence the 8-inch gun charges were supplied, and the gallant officers of the select committee allowed the captain to have his own way. The result of the firing of the seventh round was about the same as near as possible as the first and second of the 32-pounder shell on his principle, 550 yards. The eighth round from the 8-inch, with the changed charge of powder, gave the same result as the other three rounds fired from it, about from 850 to 875 yards. The experiments with the shells having been completed with the results stated, a charge of 4lb. of powder was put into the 32-pounder gun with a 32-pounder solid shot, and the range was found to be 1,000 yards ; a second round was fired with a similar charge and solid shot, with the same result, 1,000 yards. All the rounds of both guns were fired at an elevation of 3½ degrees, and showed that the service of the guns and the shells used in the British service could be depended upon when Captain Thistle's shells only in one instance made a range of 950 yards, and the three others only 550 yards, with the same advantages in every respect.

Chocolate.—It was introduced into Europe from Mexico, where it had been long used by the Spaniards in the year 1520, and by them long kept a secret from the rest of the world. Linnæus was so fond of it, that he gave the specific name, theobroma, food of the gods, to the cacao-tree which produced it. The cacao-beans lie in a fruit somewhat like a cucumber, about 5 inches long and 3½ thick, which contains from 20 to 30 beans, arranged in 5 regular rows with partitions between, and which are surrounded with a rose-coloured spongy substance, like that of water-melons. There are fruits, however, so large as to contain from 40 to 50 beans. Those grown in the West India islands, Berbice and Demerara, are much smaller, and have only from 6 to 15; their development being less perfect than in South America. After the maturation of the fruit, when their green colour has changed to a dark yellow, they are plucked, opened, their beans cleared of the marrowy substance, and spread out to dry in the air. Like almonds, they are covered with a thin skin or husk. In the West Indies they are immediately packed up for the market when they are dried; but in the Caraccas they are subjected to a species of slight fermentation, by putting them into tubs or chests, covering them with boards or stones, and turning them over every morning, to equalize the operation. They emit a good deal of moisture, lose the natural bitterness and acrimony of their taste by this process, as well as some of their weight. Instead of wooden tubs, pits or trenches dug in the ground are sometimes had recourse to for curing the beans; an operation called earthing (terrer). They are lastly exposed to the sun, and dried. The latter kind are reckoned the best; being larger, rougher, of a darker brown colour, and, when roasted, throw off their husk readily, and split into several irregular fragments; they have an agreeable mild bitterish taste, without acrimony. The Guiana and West India sorts are smaller, flatter, smoother-skinned, lighter coloured, more sharp and bitter to the taste. They answer best for the extraction of the butter of cacao, but afford a less aromatic and agreeable chocolate. According to Lampadius, the kernels of the West India cacao-beans contain, in 100 parts, besides water, 53.1 of fat or oil, 16.7 of an albuminous brown matter, which contains all the aroma of the bean, 10.91 of starch, 7¾ of gum or mucilage, 0.9 of lignine, and 2.01 of a reddish dye stuff somewhat akin to the pigment of cochineal. The husks form 12 per cent. of the weight of the beans ; they contain no fat, but besides lignine, or woody fibre, which constitutes half their weight, they yield a light brown mucilaginous extract by boiling in water. The fatty matter is of the consistence of tallow, white, of a mild agreeable taste, called butter of cacao, and not apt to turn rancid by keeping. It melts only at 122° Fahr., and should, therefore, make tolerable candles. It is soluble in boiling alcohol, but precipitates in the cold. It is obtained by exposing the beans to strong pressure in canvas bags, after they have been steamed or soaked in boiling water for some time. From 5 to 6 ounces of butter may be thus obtained from a pound of cacao. It has a reddish tinge when first expressed, but it becomes white by boiling with water. The beans, being freed from all spoiled and mouldy portions, are to be gently roasted over a fire in an iron cylinder, with holes in its ends for allowing the vapours to escape ; the apparatus being similar to a coffee-roaster. When the aroma begins to be well developed, the roasting is known to be finished ; and the beans must be turned out, cooled, and freed by fanning and sifting from their husks. The kernels are then to be converted into a paste, by trituration in a mortar heated to 130° F. The chocolate paste has usually in France a little vanilla incorporated with it, and a considerable quantity of sugar, which varies from one third of its weight to equal parts. For a pound and a half of cacao, one pod of vanilla is sufficient. Chocolate paste improves in its flavour by keeping, and should, therefore, be made in large quantities at a time. But the roasted beans soon lose their aroma if exposed to the air. Chocolate is flavoured with cinnamon and cloves, in several countries, instead of the more expensive vanilla. In roasting the beans the heat should be at first very slow, to give time to the humidity to escape ; a quick fire hardens the surface, and injures the process. In putting the paste into the tin plate, or other moulds, it must be well shaken down to ensure its filling up all the cavities, and giving the sharp and polished impression so much admired by connoisseurs. Chocolate is sometimes adulterated with starch, in which case it will form a pasty consistenced mass when treated with boiling water. The harder the slab upon which the beans are triturated the better ; and hence porphyry is far preferable to marble. The grinding rollers of the mill should be made of iron, and kept very clean.

Method of Preparing Yeast.—Without a Ferment : — (Fownes's Process.) — Common wheat-flour is to be mixed with water into a thick paste, and kept, slightly covered, in a moderately warm place, for some time. About the third day it begins to emit a little gas, and to exhale a disagreeable, sour odour, like stale milk ; after the lapse of a few days, that is, about the sixth or seventh day, the smell changes, much gas is evolved, accompanied by a distinct and agreeable vinous odour, and it is then in a state to excite the vinous fermentation. A quantity of wort is next to be prepared, and boiled with hops, in the same manner as in the brewing of beer, and, when cooled to 90° or 100°, the decomposed dough, thoroughly mixed with tepid water, is to be added, and the whole is to be kept in a warm situation. After the lapse of a few hours, active fermentation takes place, carbonic acid is disengaged, and when the action is complete, and the liquor clear, a large quantity of yeast of excellent quality is found at the bottom of the vessel. In one experiment the following materials were used :—A small handful of ordinary wheat-flour was made into a paste with cold water, covered with paper, and left seven days on the mantel-shelf of a room where a fire was kept all day, being occasionally stirred ; at the end of that period three quarts of malt were mashed in two gallons of water, the infusion boiled with the proper quantity of hops, and, when sufficiently cooled, the ferment added. The result was a quantity of beer, not very strong, but of an agreeable flavour, and a pint of thick yeast, perfectly good for making bread. This must be valuable to colonists and residents in the country. Malt is easily made, and hops may be omitted, or superseded by some other bitter. Honey 5 oz. ; powdered tartar 1 oz. ; malt 1 lb. ; water at 112° F. 3 pints, or q.s. ; stir well together, and allow the whole to rest for two or three hours, or till the temperature sinks to about 65°, at which it must be kept, covered over, when yeast will be eliminated. Boil malt, a quarter of a peck, in 3 pints of water ; pour off 2 pints, and keep it in a warm place for thirty hours ; add 4 pints of a similar decoction, stir it well in, again ferment, and repeat this addition of 4 pints until a sufficient quantity of yeast is obtained : 10 pints will yield yeast sufficient for a brewing of 40 gallons ; it is preferable to brewer's yeast, particularly when used for raising dough. With a Ferment :—(Ure.)—Bean-flour ¼ lb. ; water 6 quarts; boil for half an hour, pour the de-

coction into any suitable vessel, add wheat-flour 3½lbs.; stir well together, and, when the temperature reaches 55°, add beer yeast 2 quarts; mix well, and keep the mixture in a situation where it will not be chilled. In twenty-four hours after the commencement of the fermentation add barley or bean flour 7 lbs., make a uniform dough by thorough kneading, roll it out as thin as a dollar, and cut it with a wine-glass into small cakes, which must be placed on sieves or laths, and dried in the sun, and then preserved in a dry situation. For use, one of these discs is to be broken into pieces, laid in warm water, and set in a warm place during twelve hours, when the soft mass will serve the purpose of beer yeast. Mix two quarts of water with wheat-flour, to the consistence of thick gruel, boil it gently for half an hour, and, when almost cold, stir into it ½ lb. of sugar, and four spoonfuls of good yeast. Put the whole in a large jug or earthen vessel, with a narrow top, and place it before the fire, so that it may, by a moderate heat, ferment. The fermentation will throw up a thin liquor, which pour off and throw away; keep the remainder for use (in a cool place) in a bottle, or jug tied over. The same quantity of this, as of common yeast, will suffice to bake or brew with. Four spoonfuls of this yeast will make a fresh quantity as before, and the stock may be always kept up by fermenting the new with the remainder of the former quantity. Ordinary beer yeast may be kept fresh and fit for use for several months by placing it in a close canvas bag, and gently squeezing out the moisture in a screw-press till the remaining matter becomes as stiff as clay, in which state it must be preserved in close vessels. This method is generally adopted by the brewers in Flanders.—Another method is to well whisk the yeast till it forms a uniform liquid mass, and then to lay it with a soft paint-brush evenly and thinly on dishes, or any convenient surface, on which it can be exposed to the sun or air; and the operation must be repeated as soon as the first coat is sufficiently solid, and so on, till the layers acquire a proper thickness, when it must be detached and preserved as before. If rendered quite dry, its power of exciting fermention will be destroyed.

Epidemical Disease amongst Cattle.—The *Sherborne Journal* states that, notwithstanding the very serious and fatal disease which has during the last three years prevailed among cattle, an epidemic of an entirely different character has lately broken out among horned stock which prevails at the present time to a serious extent. The first disease, which made such frightful destruction among cows, &c., was exclusively confined to an attack of the lungs, and, despite the efforts of veterinary practitioners, the disease, in the ratio of ninety-five per cent., proved fatal. The complaint had scarcely diminished in its destructive results before the present epidemic made its appearance in the sheds of the cowkeepers of the metropolis. The disease, although not attended with such fatal results, still, from its singular character and nature, completely baffles the skill of the cow-leech or professional man, and very mature deliberation was required before the proper and necessary mode of treatment was arrived at. The prevailing epidemic consists of a species of ulcers, which form in the mouth and on the tongue of the beast, the feet being similarly affected. The blisters thus formed, the animal is rendered quite unable to take its food, although the appetite and inclination are apparently good; the tongue becomes entirely stripped of the upper surface, the skin peeling off in large flakes, and this progress of the disease continues seven or eight days, and, from the tenderness of the tongue and inability of the animal to feed, it becomes greatly reduced in condition, and the produce of milk is comparatively nothing. The feet remain tender, and in many instances the hoof separates from the foot. That the disease is contagious is an indisputable and unquestionable fact. The malady is considered a foreign introduction.

Otto of Roses, or Attar of Roses, is prepared in the East from the petals of the damask and other roses, by distillation, exposing the product to the cool night air, and skimming off the fine oil that floats on the surface. It is brought to England chiefly as presents to persons of rank, in small square or round gilt bottles, each containing about one ounce. The perfume is so fine that the hundredth part of a drop on the point of a needle will perfume a pair of gloves while they last. By liquefying by means of heat, and dropping the otto on loaf sugar and grinding it, the perfume may be very extensively diffused. Adulterated with oil of sandal-wood, spermaceti being added to imitate the crystalline appearance of the genuine. The genuine is of a pale gold colour, and of the consistency of Venice turpentine. Imitated in England by skimming the oil that is formed in the distillation of rose-water. This mixes well with oil of rhodium; but, as it is usually mixed with water, it seldom keeps long, and soon becomes rancid.

TO CORRESPONDENTS.

"Mr. Healey sends us the following note:—"Sir,—In reference to a paragraph inserted in your journal last week, permit me to say that my connection with it closed as early as June last, when it fell into the hands of mortgagees. Having your assurance that nothing offensive or disparaging to ME was meant by your paragraph, the explanation will be as satisfactory as complete by your insertion of this note.—I am, sir, your very obedient servant, T. Piers Healey." This assurance we have had very great pleasure to give Mr. Healey personally; and we now—unsolicited, uninfluenced—repeat it here.

"J. P." thus addresses us:—"Sir,—A correspondent of yours wrote respecting a tin solution sold at Birmingham which will coat paper with that metal. As it would be very useful in lining Leyden jars, &c., will you ask him in your next to give the address of maker and the prices? Can you give me the present mode of making gun-cotton and collodion?"—We have not the address of the writer; this notice, however, will probably find him. Let our correspondent look through our late notices to correspondents: he will there see a recipe for collodion. We intend very soon to give the Index which our correspondent desires.

"Amicus" wishes to know what is Mr. Ross's plan for preserving daguerreotype pictures for which he obtained a medal from the chemical section of the Society of Arts.

"Beta," having understood that Prince Albert has offered a prize of £50 for the best glass cement, would feel greatly obliged if we would in our correspondents' sheet this week give some information respecting the terms of the offer, and the kind of cement required.—We will endeavour to obtain the necessary information for both the preceding correspondents.

"Spes."—Possible, we believe, but not probable.

"Gun-barrels to Brown."—A correspondent, whose letter for the moment we have mislaid, desires us to inform him how gun-barrels are browned:—Preparation 1. Mix 1 ounce each of aquafortis and sweet spirits of nitre; 4 ounces of powdered blue vitriol; 2 ounces of tincture of iron, and water 1½ pint. Agitate until dissolved. Use: Rub this on the barrel previously well polished, and afterwards cleaned off with whiting, to remove the oil. Let it remain till the next day, then rub it off with a stiff brush. The liquid may be again applied until a proper colour is produced. When this is the case, wash in pearlash-water, and afterwards in clean water, and then polish either with the burnisher or with beeswax, or apply a coat of shellac varnish. 2. Blue vitriol and sweet spirits of nitre, of each 1 ounce; water, 1 pint. Dissolve as last. 3. Mix equal parts of butter of antimony and sweet oil, and apply the mixture to the iron previously warmed. The varnish used for gun-barrels after they are bronzed is made by dissolving 1 ounce of shellac and 1 or 2 drachms of dragon's blood in a quart of alcohol, and filtering the solution through blotting-paper into a bottle, which must be kept closely corked.

"F. B."—Steel may be covered with gilt figures of flowers, &c., by laying on by means of a pencil an ethereal solution of gold. The first coating will be thin, but may be thickened to the desired extent by laying on leaf gold and rubbing hard. The stopping should be a mixture of Spanish white sugarcandy and water.

"A Lady."—Common yellow soap is most injurious to the delicacy of the human skin, on account of the predominance of soda it contains. This renders it very well adapted for the purpose of the laundress, but is fatal to a pure complexion. Most cosmetics are injurious to the skin; some, indeed, as the magistery of bismuth, are strong poisons. Good rouge is a vegetable preparation, and less injurious than any of the white cosmetics. People are too apt to regard the skin as a smooth surface of the human body with which any liberty may be taken. No idea can be more fallacious than this. The skin is really a very complicated assemblage of organs, having functions of grave import to discharge.

"Mr. P. Baily."—Potato starch is not so good as wheaten starch for laundry purposes, because being hygrometric it absorbs water, and always keeps the linen starched with it moist and flaccid.

"N. Hayston."—The following is a good receipt for lithographic ink:—Mastic in tears 8 oz., shellac 12 oz., Venice turpentine 1 oz.; melt together; add wax 1 lb., tallow 6 oz.; when dissolved add hard tallow soap in shavings 6 oz.; when the whole is combined add lamp-black 4 oz.; mix well, cool a little, and then pour it into moulds, or on a slab, and when cold cut it into square pieces.

"Pyrophobia."—You are in error, and not your informant. Sulphur, although a combustible body, nevertheless puts out the fire in a burning chimney when thrown into the grate, simply because the gaseous result of its combustion is sulphurous acid gas, a non-supporter of combustion;—hence it puts out the fire in the burning chimney.

"A Scribe."—The mouldiness of ink depends on the growth in it of little fungi. Put a bruised clove or a little creosote into your ink-bottle, and the mouldiness will not appear.

"Mrs. Jocelyn."—A very large portion of the jellies sold by London confectioners is made from parchment cuttings procured from the vellum-binders. Ivory dust also is sold by the makers of small-tooth combs for the same purpose. When cooled, ivory dust makes a very good jelly, that merely requires to be coloured and flavoured to be sold for the jelly of calvesfeet. Both the parchment and small-tooth comb jellies are really very good, although their associations are none of the nicest.

Kakodyle, or kakodule, from *kakos*, bad, and *odôde*, smell, on account of its abominable odour, is the theoretical radical of a series of compounds, the best known of which is Cadet's fuming liqur or alkarsine, which is an oxide of kakodyl. All the preparations of this terrible compound are exceedingly poisonous. Kakodyle, moreover, spontaneously takes fire on exposure to the air.

"Mr. Stewart," inventor of the Plantagenet Razor, thus addresses us:—"Sir,—In your journal of last week you have been good enough to remark upon our guard razor. You state "that the razor is strictly a mechanical construction, and it does not fall within your sphere of comment." Permit us to draw your attention to the very important feature which we believe this guarded razor possesses, and its advantages to every member of the Pharmaceutical Society. In the hands of a chemist or of his assistant, in the event of an accident of contusion of the brain, &c., this razor could be immediately and fearlessly applied to remove the hair, in order that a dressing might be effected, to prevent the rapid effusion of blood which might occur to a dangerous extent if the sufferer had to await the arrival of a barber. We need hardly remark that these cases are almost always taken to the shop of the druggist. It is on this account that we believe the guard razor to be of great value to every chemist; and the best evidence of this fact is, many country chemists are already becoming convinced of its utility. With reference to that portion of your notice as to the galvanic action, we take leave to differ with you, because it can only be by the presence of an acid that a galvanic current can be formed between the metals; and under any circumstances, whatever may be the nature of the metal of which the guard is formed, damp will inevitably destroy the razor's edge. We gave the question great consideration before we brought out the article."—To Mr. Stewart's first proposition we agree; to his second, in which he differs with us, he is in error, as any chemist will tell him. The pressure of an acid is not essential to the setting up of a galvanic current, the damp air being amply sufficient.

"Mr. Nesbit."—Too late for this week. We go to press on Thursday night.

"A Subscriber" who desires us to tell him how to make yeast artificially is referred to the miscellaneous portion of this number.

"Mr. Pearson."—Cinnamon suet is a production of the cinnamon-tree, used in Ceylon for making candles. It is not unlike mutton suet, but is rather more yellowish. It has little taste or smell. According to Professor Christison, of Edinburgh, "it contains eight per cent. of a fluid oil, not unlike olive oil; the remainder is a waxy principle, which answers very exactly to the cerin of John."

"Mr. Thomas Hendries."—Blue ointment is often adulterated with an ointment made with rancid lard, which greatly facilitates the incorporation of the mercury, but it is rendered by this means more irritating to the skin, and still more so by turpentine, which is added for the same purpose. Sulphurated oil renders it inert by forming a sulphuret of mercury.

"A. N., Hanwell," sends us some very pretty wafers, representing Hanwell Church in silver on a blue ground, and asks us to tell him the composition of their very adhesive cement. This would require an analysis, which we have no time to perform.

A large arrear of correspondence shall be attended to next week.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—December 23, 1848.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,*
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture IV.

In my last lecture I mentioned the formation of oxalic acid from alcohol, a remarkable decomposition; I then treated minutely of radicals and compound radicals, with the view of impressing upon you their great importance; I next discussed aniline under five different names, to show how the *same* substance may be described by various chemists when obtained from different sources; I then dilated upon benzile and cinnamile, the former of which is benzoic acid, minus an atom of oxygen. As these compounds are of such value I will describe them fully. Benzoic acid exists ready formed in a variety of resins. It may be extracted from the benzoin resin by boiling with potassa and decomposing the potassa salt, formed by a mineral acid; the greatest quantity is produced when the powdered resin is heated to ebullition with milk of lime, a readily soluble salt of the earth being formed, which, on filtering, and the addition of hydrochloric acid, affords almost pure crystals of benzoic acid. Sublimation yields the acid in a perfectly pure state. Dr. Hofmann and myself attained large quantities of benzoic acid by dissolving the gum in alcohol, adding an excess of hydrochloric acid, distilling, decomposing the benzoic ether by potassa, and the benzoate of potassa with sulphuric acid. A very good method for obtaining the acid is to treat four parts of the resin with one part of dry carbonate of soda, and to rub them immediately together; add water to the mixture to form a glutinous mass, which must be left at rest for a day or two. The mass is then to be drenched with water, boiled, and the resinous substance separated. The aqueous solution, being evaporated and heated with sulphuric acid, yields almost pure acid. Re-solution in boiling water will give fine crystals of benzoic acid. The produce from the resin depends entirely upon the quality and the method employed. Benzoic acid can be obtained in beautiful acicular crystals from the resin by sublimation, but this process yields a very small amount.

According to Dessaignes this acid may also be obtained in a very beautiful manner when hippuric acid—an acid discovered by Liebig in the urine of the graminivora—is acted upon by a mineral acid. The acid combines with the glycocoll produced, as will be seen in the annexed equation :—

Hippuric acid	$C_{18}\ H_9\ O_6\ N,$
Plus two equivalents water	$H_2\ O_2$
	$C_{18}\ H_{11}\ O_8\ N,$
Minus benzoic acid	$C_{14}\ H_6\ O_4$
Hydrochlorate of glycocoll	$C_4\ H_5\ O_4\ N + HCl.$

Benzoic acid possesses no smell. When obtained from the resin by sublimation it has a peculiar agreeable odour, owing to the presence of a volatile oil. Its vapour is a most powerful irritant, affecting severely the nose and eyes. This acid is a most important compound, inasmuch as we know more of its properties than of any other organic acid, and it is of such a persistent nature that it may be passed through a tube heated to incipient redness without any decomposition being produced. It has become the foundation of a type of extremely interesting investigations, and of new theories and generalizations; and, above all, it embraces some of the best cases of substitution occurring in the whole province of organic chemistry. The carbohydrogen extending through all the compounds is $C_{14}\ H_5$, which may truly be called the radical of the series. Benzoic acid combines with most of the bases forming salts, nearly all of which are soluble in water. Acetate of potassa dissolves many of those which are insoluble in water. This acid forms few basic salts. Herzog decomposed benzoic acid, acting upon it in the sun, with chlorine gas; chlorobenzoic acid is produced, collaterally with other products. All the hydrogen in benzoic acid cannot be displaced by chlorine. Stenhouse replaced one, two, and three atoms of the hydrogen, forming monochlorinated bi and ter chlorinated benzoic acid, as represented below :—

Benzoic acid	$C_{14}\ H_5\ O_3$
Monochlorobenzoic acid.	$C_{14} \left\{ \begin{matrix} H_4 \\ Cl \end{matrix} \right\} O_3$
Bichlorobenzoic acid ...	$C_{14} \left\{ \begin{matrix} H_3 \\ Cl_2 \end{matrix} \right\} O_3$
Terchlorobenzoic acid ..	$C_{14} \left\{ \begin{matrix} H_2 \\ Cl_3 \end{matrix} \right\} O_3$

The monochlorinated acid was obtained also by Scharling when acting upon benzoic acid with aqua regia. We see in the above formula the manner in which each atom of hydrogen is substituted. Chlorobenzoic acid is so similar to the benzoic in all its relations that they can only be distinguished by analysis. This example is another great proof of what has been heretofore stated, *i.e.*, that chlorine may replace hydrogen without materially altering the leading member of a series. The behaviour of benzoic with sulphuric acid is somewhat singular. Hydrated sulphuric dissolves the benzoic acid without producing any change. Anhydrous sulphuric acid, or the teroxide of sulphur, however, when brought in contact with benzoic acid, gives rise to water and hyposulphobenzoic acid :—

$$C_{14}\ H_5\ O_3, + 2SO_3, = C_{14}\ H_4\ O_8\ S_2, + Aq.$$
$$\text{or } C_{14}\ H_4\ O_3\ S_2\ O_5, + Aq.$$

Hyposulphobenzoic acid.

Benzoic acid, according to the results of Ure and others, undergoes an interesting metamorphosis in the animal system; it is converted into hippuric acid, and eliminated from the body as hippurate of ammonia. From the preceding we may infer that the benzoic acid in its passage through the frame combines with sugar of gelatine, $C_{14}\ H_5\ O_4\ N$, and two equivalents of water, and is thus transformed into hippuric acid. When the hippuric acid is submitted to dry distillation it affords benzoic acid, benzoate of ammonia, and other products.

We come next to the effects of nitric upon benzoic acid, or the production of nitrobenzoic acid. The latter is formed by the action of boiling concentrated nitric acid upon benzoic acid until gas ceases to escape, and the liquid becomes colourless. On cooling the nitrobenzoic acid crystallizes from the menstruum, and can be purified by recrystallization. The general formulæ given for the pure acid is :—

$$C_{12}\ H_4\ O_2 + HO\ NO_5, \text{ or } C_{12}\ H_5\ O_3, + NO_5$$

A great many of the nitrogenous compounds, produced in a similar manner to the nitrobenzoic acid, possess, like it, the properties of acids, *e.g.*, nitrocinnamic acid and nitrosalicylic acid, &c. Most chemists assume the existence of nitric acid in such compounds, but I am not aware of direct proof for such an assumption. We know that the hydrogen of many compounds may be partly or wholly replaced by chlorine and bromine without altering fundamental properties. Why should not peroxide of nitrogen, NO_4, also enter such a category? Taking this view of the subject, we are again able to classify in a beautiful way the nitrogen compounds. In bodies which have acquired oxygen and nitrogen from nitric acid, we may regard such as simple products of substitution,* in which the hydrogen, instead of being replaced by chlorine or bromine, is replaced by a compound radical—peroxide of nitrogen; whilst, in the assumption of chlorine into an organic substance, the displaced hydrogen is taken up by another equivalent of chlorine, forming hydrochloric acid; in employing nitric acid, the fifth atom of oxygen combines with the replaced hydrogen, giving water. Benzoic acid, $C_{14}\ H_5\ O_3$, you have heard, furnishes, when treated with chlorine, an acid :—

$$C_{14} \left\{ \begin{matrix} H_4 \\ Cl \end{matrix} \right\} O_3$$

Chlorobenzoic acid,

scarcely distinguishable from the former. Furthermore, nitrobenzoic, produced by the action of nitric acid upon benzoic acid, has been in numerous cases mistaken for the original compound.

[*To be continued.*]

* Dr. Scoffern's Paper on Sugar next week.

* Drs. Muspratt and Hofmann, on Nitraniline, "Philosophical Magazine," No. 194, p. 315.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXVIII.

(LECTURE LXVI.)

EXTRACTIVE JUICES—(*Continued*).

CLARIFICATION.

Extractive juices are clarified by rest simply, or by filtration.

The former method is but rarely resorted to, as the juices of plants are mostly so very alterable that decomposition sets in frequently before the insoluble matters have had time to subside. Clarification by filtration is accordingly preferred. The coagulated albumen, the chlorophyle, and the vegetable débris remain on the filter, and the solution of the other matters passes transparent.

The filtration of vegetable juices proceeds always rather slowly, since the viscous deposit of gluten and albumen which collects on the filter opposes some obstacle to the free passage of the liquid.

This difficulty may, indeed, be readily overcome by heating the juice previously to pouring it on the filter, which proceeding renders the process of filtration singularly expeditious. It must, however, be borne in mind that this method admits by no means of indiscriminate application, for the portion of vegetable albumen which the juice holds in solution is coagulated by the heat, and carries away with it part of the extractive matter in which the medicinal properties of the juice reside. That this is really the case is clearly apparent from the fact that we find the cold-filtered juice more deeply coloured than the hot filtered; and that the albumen which coagulates and separates upon heating the cold-filtered juice is strongly coloured. Now, as albumen is a colourless principle, the dark tint exhibited by the coagulum can be attributed only to the colouring extractive matter which the albumen has carried away with it.

Yet there are instances in which it becomes absolutely necessary to have recourse to this method of clarification by heat, even though a portion of the extractive principle of the plant be sacrificed.

Among the aqueous juices there are a certain number derived from aromatic plants, which owe their medicinal properties in a great measure to some volatile principle. Such are the juices supplied by plants charged with essential oils, and by the cruciferæ. These juices more particularly require to be filtered cold, since, were heat resorted to with them, to the loss occasioned by the coagulation of the albumen would be superadded that resulting from the dissipation of the volatile principle.

Should circumstances, however, render it necessary or advisable to resort to the application of heat for the clarification of an aromatic juice, the best way will be to pour the juice into a matras, to close the latter with a piece of parchment, pricked with a pin, and to plunge it then repeatedly into boiling water, in order to effect the coagulation of the albumen. The juice should then be filtered, only when perfectly cold.

Acids are sometimes added to the juices for the purpose of facilitating the depuration of the latter. Thus, for instance, addition of the juice of acid oranges facilitates the clarification of the antiscorbutic juices. It is well known that, by adding sorrel to the plants intended for the preparation of a so-called juice of herbs, the juice produced is infinitely less coloured than it would be were no sorrel used. It may be assumed that the acids form with the vegetable albumen of the juices an insoluble compound, which, in its coagulation, collects and envelops all those parts which were simply held in mechanical suspension, and also a portion of those held in actual solution. Part of the precipitate formed consists here also of the oxalate of lime, resulting from the double decomposition of the binoxalate of potass with the salts of lime invariably present in the plants.

SOLUTION OF THE EXTRACTIVE MATTERS BY WATER.

In the general study of the action of water upon extractive matter we have to consider three principal cases:—

1. The extractive matter is almost pure.
2. It is mixed with lignin.
3. It is associated with lignin, and, moreover, with other matters of different degrees of solubility.

1. If the matter happens to consist almost entirely of pure extractive, the operation is exceedingly simple; the solution is effected cold, or with the aid of heat, as circumstances may indicate or require.

2. When the extractive is enveloped in the ligneous tissue, we have already seen that it may often be obtained from the fresh plant by simple expression. Dried plants, however, require the action of water, which restores to the tissues a certain degree of flexibility, and to the soluble matters their original fluidity.

The processes resorted to are maceration, digestion, infusion, decoction, and lixiviation. These processes are mostly applicable also to the fresh plants.

A.—MACERATION.

This process, though strongly recommended by modern writers as being well adapted to restore the juices in the dried plants to their original condition, appears to me rather inferior to that of infusion. Except where the matters happen to be reduced completely to a fine powder, the water is found to penetrate them with difficulty only, and decomposition will occasionally set in before the water has accomplished the intended object. I have almost invariably found that maceration exhausts plants that have been simply pounded less completely than this is done by infusion.

Maceration proves generally ineffectual for fresh plants, except the vegetable tissue be so thoroughly torn and divided that the juices find themselves in direct contact with the water.

B.—INFUSION.

Infusion is the most efficacious and convenient process of all. It is equally applicable to fresh and to dried plants. It coagulates the albumen. I have almost invariably found the products of infusion more sapid and odorous, and more copiously charged with extractive matter, than those of maceration.

Infusion is resorted to to effect the extraction of the juices from dried flowers and leaves, from amylaceous roots, which owe their properties to gummous or extractive matters, and in general from all substances containing volatile principles, or of which the active parts are soluble in water.

C.—DECOCTION.

Decoction is recommended for matters of considerable density which are difficultly penetrated by water, and contain only fixed principles. The process is continued a longer or shorter space of time, according to the degree of resistance which the vegetable tissues oppose to their penetration by the water. Generally speaking, the process of decoction ought to be resorted to but rarely, as it tends to alter the extractive matter, and to diminish, moreover, the amount of the product, from the intimate combination into which a portion of that matter enters with the vegetable fibre.

D.—LIXIVATION.

This process may be substituted for maceration and for infusion whenever it is the intention to obtain concentrated liquors.

3. The extractive matter is associated with lignin, and, moreover, with other principles of different action and solubility, some of which it may be desirable to leave undissolved. Three cases may occur here:—

A. The substance may be amylaceous.

B. It may contain some noxious principle which it is desirable to leave undissolved.

C. It may contain some useful principle, insoluble or only sparingly soluble in water.

A. Amylaceous roots should be treated in a manner to leave the starch undissolved. For this purpose maceration is universally considered the best process. The substance ought to be divided and comminuted in a manner to permit the water to act promptly and effectively; otherwise infusion must be had recourse to, more particularly in summer, to guard against fermentation, which will sometimes ensue from protracted contact of the amylaceous substance with the water. The speed with which the process of infusion accomplishes the desired end more than outweighs the disadvantages that might possibly result from the trifling admixture of starch usually found in the product.

The decoction of amylaceous roots would yield thick and turbid liquids. It may be remarked, however, that if the roots happen to be whole, and are not subjected to a very protracted decoction, the thickness and turbidity of the product are not so very considerable, because the starch is retained by the tissue of the plant, and even of the dissolved portion of the starch a part only reaches the liquid.

Notwithstanding this, however, decoction should generally be avoided, on account of the alteration which it produces in the vegetable principles, and of the diminution of these principles from their combination with the vegetable fibre.

B. Certain substances contain, besides starch, other principles which it is desirable to leave undissolved. Thus, for instance, liquorice-root contains an acrid oil, juniper berries are charged with resin, the envelope of cassia contains an astringent principle, &c. &c. In all such cases simple maceration is the best course to be pursued: the more soluble principles will dissolve, the others will remain behind.

For substances containing volatile oil by the side of bitter soluble principles decoction will answer best. Thus, for instance, camomile flowers, wormwood, orange-peel, and lemon-peel should be boiled to expel the essential oil, and to retain only the tonic febrifuge principle.

C. It may happen that the most active principle of a substance is insoluble in water, and that its extraction can be effected only by the influence of other principles, more particularly by that of extractive. In such cases protracted decoction is the only process by which we can hope to effect the solution of the medicinal principle: the insoluble red principle of cinchona, for instance, and the resin of guiaicum-wood, are obtained in solution by long-continued decoction of the bark and of the guiaicum-wood.

The preceding rules, though of pretty general, are yet not of universal, application. There are cases which present considerable difficulties in this respect, on account of our imperfect knowledge of the composition of the substances with which we have to deal. In such cases we must have recourse to the more direct experience derived from the nature of the dissolved products, or also to the results of medical observation.

What contributes principally to increase the difficulties which we encounter here on our path is the marked action which certain principles exercise upon each other, and which may considerably influence or alter their degree of solubility. So marked is this action that, as regards insoluble substances, it is hardly ever possible to rely with positive certainty upon their total absence from the products of the maceration, infusion, or decoction of the plants containing them.

I will give a few instances:—The bitter principle of columbo-root is insoluble in water; yet the simple maceration of the root suffices to dissolve this principle, because it is associated in the plant with a colouring matter or an acid which facilitate its solution; the resin and volatile oil of semen-contra dissolve in water, owing to the presence and influence of the gummous and extractive matters; Brazil-wood (according to Chevreul) and rhubarb (according to Caventou) contain binary combinations, which under the influence of water separate into two very different compounds, an insoluble one, in which the insoluble principle abounds, and a soluble one, in which the opposite principle predominates. Even the temperature would appear to exercise a marked influence upon the respective proportions of the two compounds.

The action of the solvent upon the vegetable matters seems in some cases also to give rise to the formation of new principles. Thus asparagïn, for instance, is probably a product of alteration of asparagus or of the root of marshmallow. And so in a great many cases new products may be formed, although their presence in the liquids may hitherto have escaped our attention. This opens a field of research which demands careful analyses, an attentive examination of the liquids, and, finally, the confirmation of the data obtained by means of chemistry, by those derived from medical experience.

The different purposes for which a remedy may be exhibited will also in some cases influence the mode of operation. Thus, the root of columbo yields to water, *by infusion*, a bitter principle which is used with great success as a tonic, but of which the exhibition in a state of purity would be counter-indicated in the treatment of chronic diarrhœas. The mucilaginous matter of the starch which we find associated with this bitter principle when the root has been treated *by decoction* moderates its action upon the tissues, and greatly aids its beneficial effects. Iceland moss yields *by infusion* simply a bitter drink; *by decoction* the mucilaginous principle is equally dissolved, and, setting aside the first liquor, a purely gelatinous product may be obtained. We might adduce many more instances of this kind. Ipecacuanha owed, perhaps, the high reputation which it enjoyed at one time against chronic diarrhœas to the process of decoction recommended by the physicians of that period.

Alcohol is also used to dissolve the extractive parts of plants. As extractive is soluble only in weak alcohol, the strength of this menstruum must not exceed 56 C. (21° Cartier). Tinctures are prepared by maceration; the same process, or digestion, or lixiviation, are resorted to if the alcoholic solution is intended for the preparation of an extract.

Wine and vinegar are also used as solvents of extractive matter; the alterability of the solvent renders it here imperative to operate at the common temperature.

For more minute details I refer the reader to the chapters on wine, vinegar, and alcoholic tinctures.

EXTRACTS.

Extractive is the basis of extracts; properly speaking, the latter are simply extractive brought to a high degree of concentration. Extracts contain, besides the extractive, divers other principles, with which the latter is associated in the plants. Of the several methods of extracting the juices we have already spoken. The liquors obtained are brought to the proper consistence by evaporation.

During the evaporation of the liquors the extractive matter absorbs oxygen from the air, loses thereby its solubility, and precipitates in form of a brown, pulverulent deposit, called oxygenated extractive by the ancient chemists, "apothema" by Berzelius. This alteration takes

place more particularly upon ebullition of the liquor; it is accordingly always preferable to conduct the evaporation at a temperature below 212° Fahrenheit.

Evaporation of the extractive liquors tends also to dissipate the volatile principles which they may happen to contain. This process, therefore, is not well adapted for plants or parts of plants that owe their medicinal properties to readily volatilizing principles. Yet the elimination of these principles is hardly ever complete, being checked by the presence and influence of some other constituent of the plants. In valerian, for instance, the elimination of the volatile principle is checked by the presence of resin; in the roots of the aromatic ombelliferæ by that of a fatty and resinous oil.

Notwithstanding this, however, it must be held as a general principle that the form of extractive is not well adapted for the conservation of the volatile principles of a plant.

It may be laid down as a general rule that the best way to guard against alteration is to obtain the extractive liquors in the highest possible state of concentration, to evaporate them at a low temperature, but to accelerate the evaporation otherwise by all possible means.

1. EVAPORATION IN VACUO.

The process of evaporating extractive liquors under the exhausted receiver of the air-pump (with proper provision for the absorption of the vapour by sulphuric acid, lime, or chloride of calcium) answers exceedingly well, but requires, unfortunately, apparatus which most apothecaries cannot well afford to procure.

For a detailed description of Barry's evaporation apparatus, slightly modified by Redwood, I refer the readers of these lectures to Dr. Ure's Dictionary.

Berzelius recommends to evaporate extractive liquors at ebullition heat in the boiler of an alembic; here the substance is protected from contact with the air by the vapours which constantly fill the apparatus. This process has, however, very little to recommend it, as it exposes the extractive liquors to alteration in more than one way.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

RESEARCHES ON THE COMBINATIONS OF SILICIUM.

By M. ISIDORE PIERRE.

[*Continued from page* 61.]

ESTIMATION OF THE AMOUNT OF SULPHUR IN SULPHURET OF SILICIUM.

The estimation of sulphur by means of fuming nitric acid or aqua regia yielded me results that were so little satisfactory that I was obliged to relinquish these processes.

Amongst the various processes subsequently employed, that which proved most successful was the following, which I consider to be generally applicable to the analysis of difficultly-oxidizable sulphur containing bodies whether liquid or gaseous.

The matter, contained in a little tube, is introduced to an ordinary tube of organic analysis, along with a mixture of chlorate of potash, potash, and lime. The operator having previously satisfied himself that neither of these bodies contains sulphuric acid, the operation is then conducted as follows:—I introduce into the tube, closed at one end, a mixture, of about five or six centimetres long, of three fourths of potash and lime, and one fourth of chlorate of potash; then, after having introduced the matter to be analyzed, I add upon it a column of about nine tenths of lime and potash, and one tenth of chlorate, the remainder of the tube being filled with a mixture of potash and lime.

A bulbed tube, containing a solution of chlorine, is now adapted to the extremity of the organic analysis tube, in order to remove and to transform into sulphuric acid the sulphurous acid which may be disengaged.

And here I ought to remark that I have never found any considerable portion of sulphuric acid to be thus present, demonstrating that but minute traces of sulphurous acid had passed over.

The combustion-part of the operation is conducted in the usual manner of organic analyses.

ESTIMATION OF THE AMOUNT OF SILICIUM.

This element was estimated in the condition of silicic acid.

The matter was introduced, as if for the estimation of chlorine, into a flask *à l'emeri*, only the flask, instead of containing *dilute* nitric acid, was supplied with the concentrated and fuming material.

When, after many smart shocks, the tube containing the material had become broken, the flask was agitated many times following, and after considerable intervals of rest, taking care not to unclose the flask, so that any traces of gas might thereby escape, and thus vitiate the correctness of the result.

The following day the contents of the flask were poured into a matras having a very narrow neck, to which externally was adapted, by means of a cork, a curved tube, the extremity of which is plunged to the depth of some millimetres into a little water, in order to effect the condensation of the volatilized matters.

The liquid was now boiled for many hours, with the addition from time to time of a little pure and concentrated hydrochloric acid. Thus almost the entire amount of silicic acid separated from the liquor in flocks.

The deposited silicic acid having been well washed with pure water was then filtered, and the filtrates, when united to the liquid into which the tube of disengagement had been plunged, were evaporated by a gentle heat to dryness. They only yielded as a residue a very small amount of silicic acid, which was added to the other portion.

After having calcined and weighed the whole it was treated with a solution of caustic potash, in order to separate the silicic acid from some little fragments of glass from the broken tube. The difference between the two weights gave the amount of silica.

A preliminary trial made upon the chloride of silicium had indicated that this plan of analysis might be relied upon as correct and trustworthy.

0.4285 grammes of material thus treated yielded 0.1775 of silicic acid corresponding with 19.54 of silicium. By uniting in the tabular form the results of these different analyses, the following exposition is arrived at:—

	I.	II.	III.	IV.	V.	VI.
Chlorine..	65.79	65.81	65.03	—	—	—
Sulphur..	..	..	..	1501	1520	—
Silicium...	...	..	...	...	..	19.54

That is to say, that the mean of the various analyses gives as the composition of this substance:—

Chlorine	65.51
Sulphur	15.10
Silicium	19.54

Now, if we assume that the equivalent of silicium is S = 266.82, that is to say, that the equivalent is the corresponding one to the formula, $Si\ O_3$, for silicic acid, and to the formula, $Si\ Cl_3$, for the chloride of silicium, the preceding results will be represented with much precision by the formula, $Si\ S\ Cl_2$ which would require—

Chlorine	65.47
Sulphur	14.83
Silicium	19.70

The formation of this compound, to which I propose to give the name of *chlorosulphuret of silicium*, indicates a very simple play of reagency, $Si\ Cl_3 + HS = S_2\ SCl_2 + HCl$; that is to say, one is led to consider the chlorosulphuret of silicium in the light of chloride of silicium, in which one equivalent of chlorine has been replaced by one equivalent of sulphur. By adopting the formula, SiO_2, the new compound would be expressed by the formula, $Si_3\ S_2\ Cl_4$, and the reaction to which it gives rise by the equation, $3Si\ Cl_2 + 2HS = Si_3\ S_2\ Cl_4 + 2HCl$. In short, if the formula be adopted of SiO, then the chlorosulphuret of silicium would be represented by $Si_3\ SCl_2$, and the equation expressive of the reaction by $3Si\ Cl + HS = Si_3\ SCl_2 + HCl$.

The two latter hypotheses lead us to express the new compound by a formula much more complex than that by which we are naturally conducted by the hypothesis Si = 266.82. This complication seems to cause an idea of a mixture which would appear to exclude both the *ensemble* of the properties of the chlorosulphuret and the concordance of results obtained by analysis of samples resulting from various operations.

I imagined that a determination of the specific gravity of the vapour of this compound might afford some important information relative to its constitution.

A preliminary experiment, made upon an insufficient quantity of material,—although the whole which I at that time possessed, gave me 4.78 as the result.

Two new determinations made upon a product of another operation gave me successively the figures 5.24 at 161° for the first, and 5.32 at 154.5° for the second. The density calculated from the formula $Si\ S\ Cl_2 = 3$ volumes leads to the number 5.03. On the supposition that it equals 2 volumes, then the result would be 7.545; and if 4 volumes, we should arrive at the number 3.77.

The choice is not doubtful, if we admit that the chlorosulphuret of silicium presents the same mode of condensation as the chloride, $Si\ Cl_3$.

The question which then presents itself is the following:—Are we to consider the chloride of silicium as a primitive molecular type, capable of giving by successive substitutions:—

$Si\ Cl_3$
$Si\ S\ Cl_2$
$Si\ S_2\ Cl$
$Si\ S_3$.

We actually are aware of the two first, and the latter term of this series of compounds, and, to complete the series, only the term $Si\ S_2\ Cl$ remains to be discovered.

In order to obtain it I slowly poured through a strongly-heated porcelain tube some chlorosulphuret, $Si\ SCl_2$, in vapour, along with an excess of hydrosulphuric acid gas. By this procedure I obtained a very small amount (0.3185 gramme) of a liquid, in which I discovered by analysis 52.84 per cent. of chlorine. A new operation, conducted in a similar manner, yielded 0.611 gramme of a liquid containing 54.39 per cent. of chlorine.

A third experiment having been made upon a still larger scale, in order to obtain the compound $Si\ S_2\ Cl$, which should only contain 39.87 per cent. of chlorine, I distilled several times in succession a portion of the product until no further residue was found in the retort, avoiding at each distillation to push the operation further than the commencement of an appearance of white vapours. The liquid product resulting from these various distillations yielded on analysis 65.41 per cent. of chlorine. I then returned to the chlorosulphuret, $Si\ S\ Cl_2$; but how was it that this liquid only contained from 53 to 54 per cent. of chlorine? The small quantity of material which I obtained in each operation did not admit of a complete analysis, on account of my being obliged to operate on a separate quantity for each successive determination of the various elements.

If we limit ourselves to the consideration, what is the possible formula that shall satisfy the conditions which result from the data afforded by the previously detailed experiments, we find that the formula $Si\ S_{\frac{3}{2}}\ Cl_{\frac{3}{2}}$ or, doubling it,

$$\overline{Si_2\ S_3\ Cl_3}$$

the formula $Si_2\ S_3\ Cl_3$, would yield 53.52 per cent. of chlorine.

But, if we resolve that this material has not been, could not be, purified by distillation, it might happen, nay, it must happen, that it holds in solution a more or less quantity of hydro-

chloric acid which is formed consentaneously with itself. If it be admitted that the compound $Si\ S_2\ Cl$ was really generated, and that it had absorbed all the hydrochloric acid produced during the transformation of the chlorosulphuret, $Si\ Cl_2\ S$, into $Si\ S_2\ Cl$, under the influence of hydrosulphuric acid, the liquid under consideration ought to be represented by

$$Si\ S_2\ Cl + Cl\ H.$$

It is somewhat remarkable to find that this formula would yield 53.99 per cent. of chlorine. On the other side, if we remember that by simple distillation this liquid is decomposed with the formation of the chlorosulphuret, $Si\ S\ Cl_2$, and leaving a solid residue which possesses all the properties which Berzelius assigns to sulphuret of silicium, we are again induced to regard in another manner the possible constitution of that substance. Might it not be a mixture of chlorosulphuret and sulphuret of silicium held in solution in the former of these two substances?

The formula, $2Si_2\ S_3\ Cl_3 = 3Si\ S\ Cl_2 + Si\ S_3$, explains the kind of decomposition which distillation would cause this body to undergo. But, hypothesis for hypothesis, we might admit that the liquid matter, which contains from fifty-three to fifty-four per cent. of chlorine, if we suppose it represented by $Si_2\ S_3\ Cl_3$, is a mixture of the two compounds, $Si\ S\ Cl_2$ and $Si\ S_2\ Cl$, or, in other words, that $Si\ S\ Cl_2 + Si\ S_2\ Cl = Si_2\ S_3\ Cl_3$.

It suffices, in order to explain the final result of distillation, to admit that $Si\ S_2\ Cl$ is decomposed under the influence of heat into chlorosulphuret and sulphur, as the equation, $2Si\ S_2\ Cl = Si\ S\ Cl_2 + Si\ S_3$, would indicate.

[*To be continued.*]

MM. FIGUIER AND L. MIALHE ON THE ANALYSES OF THE PRINCIPAL MINERAL WATERS OF GERMANY.

ANALYSIS OF THE THREE SOURCES OF THE MINERAL WATER OF CARLSBAD.

(1.) Source Kochbrunnen. A litre* of the water yielded:—

Chloride of sodium	7.332
" magnesium	0.246
" potassium	0.038
Sulphate of lime	0.085
Carbonate of lime	0.180
" magnesia	0.008
" protoxide of iron	0.009
Silicate of soda	0.183
Bromide of magnesium	0.019
	8.100

(2.) Source of the Cologne Hotel:—

Chloride of sodium	6.791
" magnesium	0.280
" potassium	0.101
Sulphate of lime	0.136
Carbonate of lime	0.156
" magnesia	traces
" protoxide of iron	0.010
Silicate of soda	traces
Bromide of magnesium	0.016
	7.484

(3.) The Eagle source:—

Chloride of sodium	7.136
" magnesium	0.254
" potassium	0.043
Sulphate of lime	0.098
Carbonate of lime	0.050
" magnesia	0. traces
" protoxide of iron	0.015
Silicate of soda	0.041
Bromide of magnesium	0.008
	8.225†

* A litre is equal to 1 pint, 15 fluid ounces, 1 fluid do., and 16 minims.

† In these analyses there is no account of the arsenic said to exist, according to the researches of Walchner, Figuier, and Mialhe.

Two sources of the mineral water of Nauheim yielded the following results:—

(1.) Source No. 2:—

Chloride of sodium	23.046
" magnesium	3.760
" potassium	1.005
Sulphate of lime	0.627
Carbonate of lime	1.095
" protoxide of iron	0.121
Silicate of soda	0.039
Bromide of magnesium	0.090
	29.783

(2.) Source No. 5:—

Chloride of sodium	27.333
" magnesium	2.653
" potassium	"
Sulphate of lime	0.047
Carbonate of lime	1.280
" protoxide of iron	0.016
Silicate of soda	0.005
Bromide of magnesium	0.100
	31.434

The two principal sources of Hombourg yielded the following results:—

(1.) Elizabeth source:—

Chloride of sodium	10.649
" magnesium	1.187
" potassium	0.030
Sulphate of lime	0.027
Carbonate of lime	0.940
" magnesia	0.330
" protoxide of iron	0.043
Silicate of soda	0.064
	13.300

(2.) The Emperor's source:—

Chloride of sodium	16.024
" magnesium	1.302
" potassium	0.027
Sulphate of lime	0.018
Carbonate of lime	0.027
" magnesia	traces
" protoxide of iron	0.097
Silicate of soda	0.031
	18.523

The following is the result of an analysis of the sources of Soden:—

(1.) Source No. 6, A:—

Chloride of sodium	14.327
" magnesium	0.311
" potassium	0.207
Sulphate of lime	0.094
Carbonate of lime	0.540
" magnesia	0.108
" protoxide of iron	0.045
Silicate of soda	0.061
Alumina	traces
	15.691

(2.) Source No. 6, B:—

Chloride of sodium	10.898
" magnesium	7.284
" potassium	0.229
Sulphate of lime	0.082
Carbonate of lime	0.979
" magnesia	0.098
" protoxide of iron	0.037
Silicate of soda	0.064
Alumina	traces
	12.671

The mineral waters of Baden, of Kreuznach, and of Kissingen present the greatest analogies of composition with the preceding. As their analyses have been made by Koestner, Liebig, and Vogel, the present experimenters have contented themselves by referring to those great authorities.

The French mineral waters which most resemble in apposition the mineral waters in Germany, of which the analysis has been given, are those of Bourbonne, Balaruc, and Niederbronn. The following is an analysis of them.

The mineral water of Niederbronn, in Alsace, yielded the following results:—

Water of Niederbronn:—

Chloride of sodium	3.070
" magnesium	0.288
" potassium	0.260
" calcium	0.825
Sulphate of lime	0.090
Carbonate of lime	0.120
Bromide of sodium	0.040
Carbonate of protoxide of iron	0.091
" magnesia, " alumina, " oxide of manganese, " silicate of iron*	traces

The water of Bourbonne gave us the following results for the two sources of the place and of the establishment:—

(1.) Source of the place:—

Chloride of sodium	5.783
" magnesium	0.392
Sulphate of lime	0.899
" potash	0.149
Carbonate of lime	0.108
Bromide of sodium	0.065
Silicate of soda	0.120
Alumina	0.030
	7.546

(2.) Interior source of the establishment:—

Chloride of sodium	5.771
" magnesium	0.381
Sulphate of lime	0.098
Bromide of sodium	0.054
Silicate of soda	0.120
Alumina	0.029†
	7.471

The following analysis of the water of Balaruc is taken from a work entitled "Nouvelles Observations sur la Source Thermale de Balaruc," by MM. Marcel de Serres and L. Figuier:—

Water of Balaruc:—

Chloride of sodium	6.802
" magnesium	1.074
Sulphate of lime	0.803
" potash	0.053
Carbonate of lime	0.270
" magnesia	0.039
Silicate of soda	0.031
Bromide of sodium	0.003
" magnesium	0.032
Oxide of iron	traces‡

All these mineral waters present a remarkable analogy of composition with that of sea-water, which may be regarded as the true type of saline mineral waters. The following are the results furnished by the analysis of a litre of sea-water collected at a distance of some leagues from Havre:—

Analysis of sea-water:—

Chloride of sodium	25.704
" magnesium	2.905
Sulphate of magnesia	2.462
" lime	1.210
" potash	0.094
Carbonate of lime	0.132
Silicate of soda	0.017
Bromide of sodium	0.103
" magnesium	0.030
Oxide of iron, carbonate of magnesia, and phosphate of magnesia	traces

If in like manner we review the analyses of other mineral waters, it will be very easy to seize their analogies. The waters of Nauheim, Baden, Wiesbaden, Kissingen, Kreuznach, Hombourg, and the French mineral waters of Niederbronn, Bourbonne, and Balaruc contain all the same mineral principles; the only variation between the several waters being merely that of relative proportion of ingredients.

The only sensible difference between them is

* The water of Niederbronn contains a small quantity of arsenic.

† The presence of arsenic has been demonstrated in the waters of Bourbonne.

‡ According to M. Poumarède, the waters of Balaruc contain minute traces of arsenic.

in the proportion of sulphate of lime and carbonate of iron, the German mineral waters being a little more ferruginous than those of France, whereas the latter abound a little more in gypsum. It will be remarked, moreover, that all the waters mentioned here bear a great resemblance to sea-water in composition. In order to ascertain to what extent the French mineral waters might be substituted for those of Germany, we determined the quantity of bromide contained in the mother liquors of the saline springs of Nauheim and Kreuznach, and the residue of evaporation of the saline springs of Salis in Bearn. The following results were obtained :—

A kilogramme of the mother water of Kreuznach, having the density of 1.293, contained 316 grammes six tenths of soluble matter ; amongst the salts 2.6 of bromide of magnesium and 8.7 of bromide of sodium were found. A kilogramme of the mother water of Nauheim, having a density of 1.381, contained 383.3 grammes of soluble material, and amongst the salts 1.43 grammes of bromide of magnesium and 2.60 of bromide of sodium were discovered.

According to these results, two pints by volume of the mother waters of the saline springs of Bearn contain pretty nearly as much bromide as the mother water of Nauheim, and hence would seem to be competent to produce a double therapeutic effect. The results mentioned in the work would appear to open an interesting way of employing the French mineral waters. The mixture of our thermal springs with sea-water, the addition to the same mineral waters of the saline constituents of the ocean, or the addition of the same to another portion of sea-water, heated to the necessary degree, of simulating the thermal spring, might be so many means of rendering service to the therapeutic art. By such artifices, judiciously employed, might probably be supplied in many cases the principal mineral waters of Germany which enjoy a merited reputation. It is manifestly evident that medical observations alone will tend to the appreciation of the real value of the idea. Our object in publishing this investigation is for the purpose of directing the attention of physicians who live in the proper localities to the interesting subject which presents itself to them for investigation.—*Journ. de Chim. Médicale*, No. 11, Nov., 1848, p. 635 et seq.

EXAMINATION FOR ARSENIC AND COPPER IN THE FERRUGINOUS WATERS OF ROUEN.

By M. J. GIRARDIN.

M. Girardin, in a letter to MM. Chevallier and Gobly, refers to a memoir by these two gentlemen, entitled " Récherchés sur la Présence de l'Arsenic dans les eaux Minerales et dans les Depôts qu'elles Fournissent,"* in which the authors appeal to the chemists of Rouen to place beyond doubt the assertion that the waters of la Maréquerie contained arsenic and copper.

The following are some analyses which M. Girardin had recourse to for the determination of that point :—

I. *Water of la Maréquerie.*—Twenty-eight litres of the water being evaporated to dryness with care yielded 9.70 grammes of ochreous residue. This residue I boiled with an excess of nitric acid with the crystals of some chlorate of potash, the better to destroy all traces of organic matter. I then treated the residue with concentrated sulphuric acid, in order to dissipate the compounds of nitrogen and chlorine. The saline matter when dried was introduced into a Marsh's apparatus, liberating pure hydrogen, and the resulting gas examined for more than a quarter of an hour, during which period not the smallest trace of arsenic was discernible.

I then acted upon 1,200 grammes of the natural ochreous deposit which settled in a basin which had been put to catch the water as it rises from the spring. From this I could not succeed in extracting the slightest particle of arsenic, although I operated with all possible care.

Inasmuch as the deposit contains sulphurets of alkalis, in considerable proportions, I, for an instant, supposed that the arsenic might exist in the state of sulphuret. To satisfy myself whether this supposition were correct, I treated with caustic ammonia, several times in succession, the deposit, previously dried and powdered.

The ammoniacal liquor upon evaporation only left a residue insignificant in amount, and devoid of the slightest trace of arsenic, as was proved by boiling it successively with nitric and with sulphuric acid, and afterwards operating by Marsh's apparatus. The water *de la Maréquerie* then contains no arsenic, and I have also perfectly satisfied myself that it contains no copper.

II. *Water of St. Paul.*—Half a century has now elapsed since the waters of St. Paul began to be much frequented. They emerge from the base of the mountain St. Catherine in a pleasure-ground situated on the banks of the Seine. There are four distinct sources or fountains, called respectively La Paule, L'Argentée, La Celeste, and La Dorée. The latter, situated nearest to the Seine, is least ferruginous of the triad. The former, farthest removed from the Seine, had the character of being most potent.

Towards the end of the last century the mineral establishment of St. Paul was converted into a velvet manufactory, then some time afterwards into a dyeing establishment. At present the property is owned by M. Lepricard, who has established there a dyeing concern and a thread manufactory. Of these four fountains two have been closed, the most ferruginous of the lot, called la Paule, alone remaining open. It flows into a stone basin, of which the sides and the bottom are covered with an ochreous deposition. The temperature of this water is still the same as in 1778, when it was under the care of Lepecq-de-la-Clôture, namely, 12.5 degrees of Centigrade.

It is upon the water of this very fountain that I operated. The water was clear, transparent, odourless, having a strong ferruginous taste. It reddened litmus paper exposed to it for a quarter of an hour. By concentration it became coloured, and threw down an ochreous deposit.

Forty litres yielded by careful investigation a reddish deposit, the weight of which was 9.5 grammes. This residue, properly treated, did not yield the slightest trace of arsenic or of copper. Indeed, it had the same composition as the natural ochreous deposit already described.

Recent Analyses of the Ferruginous Waters of Rouen.—These analyses, made in 1842 by MM. Preisser and Girardin, were communicated to the Rouen Academy of Sciences in 1843, but have not hitherto been made public ; in fact, the analyses in question constitute a portion of a large work on the mineral waters of that department not yet finished.

In 1603 the Sieur Antoine, equerry of the Duke of Montpensier, discovered the ferruginous springs of Rouen. James Duval mentions them in his " Hydrotherapeutique," published in the same year.

The analyses, or most of the chemical experiments, made upon those waters by Balthase Néel, Michel Cottard, Ledanois, Boisduval, Nihell Lechandelier, and Monnet, were insufficient to explain their true composition.

It was Dubuc who first, in 1806, explained that this iron existed in the state of carbonate, in the proportion of one grain to every pint, in the waters of la Maréquerie, and that it was associated with *muriate* and carbonate of lime, vegetable extractive, and carbonic acid, held in solution. In 1814 Vogel the elder confirmed the analysis of Dubuc, and, after many trials made by him, he affirmed that the waters of la Maréquerie contained, besides carbonic acid, carbonate of lime, carbonate of iron, sulphate of lime, and sulphate and muriate of magnesia.

The following is the composition (as determined by the present authors in 1842) of the waters of Saint Paul and de la Maréqueric :—

Principles contained in one litre of water :—

	St. Paul.	La Maréquerie.
Free carbonic acid	0.001	0.002
Silica	0.002	0.003
Carbonate of iron, with crenate of ditto	0.069	0.094
" lime	0.068	0.079
" magnesia	"	0.011
Chloride of calcium	0.046	0.087
" magnesium	0.028	0.041
Sulphate of lime	0.008	0.012
" magnesia	2.006	0.008
" iron	traces	0.001
" alumina	traces	traces
Bituminous organic matter, Crenic and apocrenic acids	0.002	0.007
Loss	0.003	"
	0.233	0.345

It will be observed that the waters of Rouen are very much charged with iron, and in this respect they may be placed in the first class in the list of ferruginous mineral waters. The waters of la Maréquerie are even richer than those of Forges, and assuredly they do not merit the neglect into which they have fallen.

ANALYSIS OF THE WATERS OF THE RIVER EXE AND OF THE BATH WATER-WORKS.

By THORNTON J. HERAPATH, Esq.

I. WATER OF THE RIVER EXE.

The sample operated upon was taken from the middle of the river at Exeter, just above the bridge, during high tide, on the 1st of August last.

An imperial gallon, or 70,000 grs., was found upon analysis to contain—

Carbonic acid gas, at 55° F., 7.016 cubic inches.

Fixed constituents :—

Chloride of calcium	traces
Chloride of magnesium	0.640
Sulphate of magnesia	0.160
Sulphate of soda	0.080
Crenate and apocrenate of magnesia	traces
Organic matter	1.600
Nitrate of lime	0.160
Carbonate of potash	traces
Chloride of sodium	4.240
Carbonate of lime	0.896
Carbonate of magnesia	0.064
Carbonate of protoxide of iron	traces
Sulphate of lime	3.040
Phosphate of lime	very minute traces
Silica	traces
	10.880

As the principal object of the inquiry was to ascertain, if possible, whether the water contained such a large proportion of organic matter as, from its tendency to putrefy, would render it unfit for the purposes of the brewer, a portion of the water was taken, and tested with chloride of gold in the manner described by M. A. Dupasquier, when by the brownish-red tint assumed by the solution, after exposure to the light of the sun, an abnormal quantity of organic matter was proved to be present.

In order to determine the proportion of nitrogenized matters contained in the water, the salts which remained after the evaporation of an imperial gallon of the water were taken and burnt with potash and lime ; they furnished 5.44 grs. of ammonio-chloride of platinum, corresponding to 0.336 gr. of nitrogen or 0.400 gr. of ammonia.

II. WATER FROM BEACON-HILL, NEAR BATH.

The specimen of the water forwarded to us was said to be similar to that usually supplied by the corporation to the citizens of Bath.

It was collected on March 22, 1848.

There being a slight perforation of the cork of the bottle in which the water was sent to us for analysis, it was considered useless to attempt to ascertain the proportion of gaseous carbonic acid.

* Communicated to the Academy, March 28, 1848.

An imperial gallon of water contained of—	
Chloride of calcium Chloride of magnesium	1.120
Sulphate of soda with some sulphate of magnesia	0.320
Crenate of magnesia	0.080
Apocrenate of magnesia	0.040
Nitrate of lime or magnesia	traces
Nitrogenous organic matter	a little
Carbonate of potash	0.010
Chloride of sodium	4.000
Carbonate of lime	11.200
Carbonate of magnesia	very minute traces
Carbonate of the protoxide of iron	0.012
Sulphate of lime	4.480
Phosphate of lime	none
Bitumen (?)	traces
Silica	traces
	21.262

—*Chemical Gazette.*

FOREIGN SCIENTIFIC INTELLIGENCE.

ON THE EQUIVALENT OF AZOTE.

The equivalent of azote was deduced by Pelouze from the chloride of ammonium, the chlorine of which having been ascertained and put down as 175.18.

Erdmann and Marchand offer some measures of precaution in order to avoid obtaining any erroneous results. When substances are examined which contain nitric acid, or which, containing azote, are produced by the action of nitric acid, it very easily happens that nitrous acid is formed, and as such goes over to the alkaline solution, which latter thereby obtains a yellow colour. This may be avoided by allowing the stream of gas, before proceeding from the combustion-tube, to pass over a stratum of metallic copper minutely divided.

ANALYSIS OF IMPURE AIR.

Lassaigne has examined the nature of the air of those places where men and animals were living in a crowded state, and where there was hardly any communication with the external atmosphere. The results obtained were almost invariably the same. Of 100 volumes of air there were 79.35 to 80.10 azote, 19.35 to 20.10 oxygen, 0.52 to 0.62 carbonic acid. The air near the ceiling contained as much carbonic acid as that near the floor.

Gräger of Mühlhausen ascertained the proportion of ammonia contained in the atmospheric air, by allowing the latter to pass through hydrochloric acid, and binding it thus to platina. He found that 1.06 cubic metre at 0° C. contained 0.0008466 grammes of carbonate of ammonia, or that 100,000 parts of atmospheric air contained 0.6148, that is, three-fifth millionths, of carbonate of ammonia. An inquiry on rainy days and in dry weather was attended with the same results.

ARSENIC IN SULPHURIC ACID.

According to Dupasquier, arsenic is found in sulphuric acid, as arsenious acid. He does not think that hydrosulphuric gas is capable of removing all arsenic; but the of sulphuretted alkalis, and more especally sulphuret of barium, are best adapted for it. Wöhler informs us that the considerable portion of arsenic contained (according to Meuser) in the sulphuric acid from Goslar attracted the attention of the Government, and the experiments instituted for the removal of that impurity have shown that 10,000 pounds of the acid when analyzed, according to Schnedermann, contained three tenths of a pound of arsenic. Quite a similar result was obtained by Herzog. The special result of these two analyses was as follows:—

	Schned.	Herzog.
Sulphuric acid (free from water)	7749.10	7857.14
Water	2243.54	2135.33
Sulphate of potassa and soda	1.35	2.41
Oxide of lead	1.72	1.99
Oxide of iron	2.91	1.25
Alumina	...	0.99
Lime	0.58	0.26
Arsenious acid	0.31	0.39
Oxide of antimony, with traces of oxide of lead	0.49	0.24
Sulphurous acid	..	traces
	10000.00	10000.00

PHOSPHORESCENT LIGHT.

Fischer has instituted a series of experiments on the light produced from phosphorus, from which it appears that this phenomenon only attends the oxidation of the phosphorus, and can, therefore, only be obtained when the metal is exposed to some kind of air containing oxygen, and until the latter is wholly consumed. In the vacuum of Torricelli no light whatever can be obtained even by heating the phosphorus to the boiling point.

NEW INVESTIGATIONS ON SEA-WATER.

Forchhammer has found the water of the Mediterranean in the neighbourhood of Malta to contain more salt water than that of any other locality. 1,000 parts of it contained 37.177 solid matters, and among these 20.046 chlorine. All sea-water after being filtered contains carbonate and phosphate of lime in solution, also silica; but of the latter never more than 0.03 in 1,000 parts. Lewy ascertained the nature of gases contained by the sea in solution at various times of the day. The experiments were instituted in the months of August and September near Langrune (department of Calvados), and from them it appears that there is more oxygen at daytime than at night, but, as regards carbonic gas, just the contrary is the case. The portion of oxygen varied from 32.5 to 34.4 per cent.; that of carbonic acid from 12.0 to 19.4 per cent.; that of azote from 48.1 to 53.7 per cent. There was also found a small quantity of hydrosulphuric acid, about 0.25 to 0.75 per cent.

E. KOPP ON BALSAM OF TOLU.

Balsam of tolu has been submitted to a new analysis by E. Kopp, and found to be composed of a small quantity of tolen (C_{10} H_8), acid of cinnamom (not benzoic acid), of a resin easily soluble in alcohol (C_{36} H_{19} O_8), and of another resin which is difficultly soluble in alcohol (C_{18} H_{10} O_5 or C_{36} H_{20} O_{10}). Tolen is colourless, very fluid, of a smell similar to that of elemi, its taste is sharp, not dissimilar to that of pepper, and its specific gravity 0.858; its boiling point is at 154—160°; exposed to the air, it thickens in the course of time. Under the influence of the atmospheric air, cinnamomic acid and a resin, difficultly soluble in alcohol, gradually develop themselves; the chemical composition of the balsam appears, therefore, to be originally very simple.—*Poggendorff's Annalen*, Oct., 1848.

Stained-Glass Pigments. — Flesh Colour: Take an ounce of red lead, two ounces of red enamel (Venetian glass enamel, from alum and copperas calcined together), grind them to fine powder, and work this up with spirits (alcohol) upon a hard stone. When slightly baked, this produces a fine flesh colour. Black Colour: Take fourteen ounces and a half of smithy scales of iron, mix them with two ounces of white glass (crystals), an ounce of antimony, and half an ounce of manganese; pound and grind these ingredients together with strong vinegar. A brilliant black may also be obtained by a mixture of cobalt blue with the oxides of manganese and iron. Another black is made from three parts of crystal glass, two parts of oxide of copper, and one of (glass of) antimony worked up together, as above. Brown Colour: An ounce of white glass or enamel, half an ounce of good manganese; ground together. Red, Rose, and Brown Colours are made from peroxide of iron, prepared by nitric acid. The flux consists of borax, sand, and minium in small quantity. Red colour may be likewise obtained from one ounce of red chalk pounded, mixed with two ounces of white hard enamel, and a little peroxide of copper. A red may also be composed of rust of iron, glass of antimony, yellow glass of lead, such as is used by potters (or litharge), each in equal quantity; to which a little sulphuret of silver is added. This composition, well ground, produces a very fine red colour on glass. When protoxide of copper is used to stain glass, it assumes a bright red or green colour, according as the glass is more or less heated in the furnace, the former corresponding to the orange protoxide, the latter having the copper in the state of peroxide. Bistres and Brown Reds may be obtained by mixtures of manganese, orange oxide of copper, and the oxide of iron called umber, in different proportions. They must be previously fused with vitreous solvents. Green Colour: Two ounces of brass calcined into an oxide, two ounces of minium, and eight ounces of white sand; reduce them to a fine powder, which is to be enclosed in a well-luted crucible, and heated strongly in an air-furnace for an hour. When the mixture is cold, grind it in a brass mortar. Green may, however, be advantageously produced by a yellow on one side, and a blue on the other. Oxide of chrome has been also employed to stain glass green. A Fine Yellow Colour: Take fine silver laminated thin, dissolve in nitric acid, dilute with abundance of water, and precipitate with solution of sea salt. Mix this chloride of silver, in a dry powder, with three times its weight of pipe-clay well burnt and pounded. The back of the glass pane is to be painted with this powder; for when painted on the face it is apt to run into the other colours. Another yellow can be made by mixing sulphuret of silver with glass of antimony, and yellow ochre previously calcined to a red-brown tint. Work all these powders together, and paint on the back of the glass. Or silver laminæ melted with sulphur, and glass of antimony, thrown into cold water, and afterwards ground to powder, afford a yellow. A pale yellow may be made with the powder resulting from brass, sulphur, and glass of antimony, calcined together in a crucible till they cease to smoke; and then mixed with a little burnt yellow ochre. The fine yellow of M. Merand is prepared from chloride of silver, oxide of zinc, white clay, and rust of iron. This mixture, simply ground, is applied on the glass. Orange Colour: Take one part of silver powder, as precipated from the nitate of that metal by plates of copper, and washed; mix it with one part of red ochre and one of yellow, by careful trituration; grind into a thin pap with oil of turpentine or lavender, and apply this with a brush, dry, and burn in.

Syrupus Quiniæ di Sulphatis.—Magendie's Formula. Syrup of disulphate of quinia. Take 2lb. of syrup, 44 grains of disulphate of quinia; mix, and give doses of 1 dr. to 4 dr. or 6 dr., divided into smaller doses, in the course of the day. It is efficacious in the strumous disorders of children.

THE CHEMICAL TIMES.

SATURDAY, DECEMBER 30, 1848.

OUR OWN SERIES.

No. V.

ON CHEMICAL MANIPULATION.

Glass Bending, Sealing, and Blowing.

The preparatory operation of glass-cutting having been well mastered, the manipulations of bending, sealing, and blowing will be the learner's next advance.

The usual instrument for effecting these operations is the table blowpipe, as it is called, and which consists of a fixed blowpipe jet, the blast for which is supplied by a pair of bellows worked by the foot; but an expert manipulator with the ordinary mouth blowpipe will seldom be brought to a standstill for want of the bellows instrument. It must be confessed, however, that the mouth blowpipe requires con-

siderable time and practice before it can be employed continually without stopping to breathe; and, even this being accomplished, the art has yet to be acquired of keeping up a steady blast without holding the instrument in one hand. Therefore, for the present, we will assume the learner to be incapable of using the mouth blowpipe, and to be provided with the bellows instrument.

Before setting to work let us see that the apparatus is in order. The jet may be made of brass; but, perhaps, it is still better made of hard green, and therefore somewhat infusible, glass—such, for instance, as the neck of an eau de Cologne bottle. The lamp may be made of tin, copper, or iron, and the surface for the wick should at least be capable of admitting a wick of one inch in length, by one fourth of an inch wide. Smaller wicks than this may answer for many purposes, but for others would supply an inadequate flame. Indeed, a large wick may always, by mere trimming, be made to supply a small flame, whereas small wicks cannot be pulled out to the extent of supplying a large one. Nay, a long wick is, for general uses, highly improper, and only to be employed on some especial occasions, when a necessity arises for obtaining during a short period an unusually large body of flame.

A great deal of care should be devoted to the preparation of the wick, on the goodness of which much of the success of the future glass-blowing operations will depend. The first matter to be remembered is, not to force too large a body of cotton into the wick-sheath; as a general rule only sufficient should be inserted to impart a degree of impaction just sufficient to prevent the burning or extreme part of the wick from sinking into the body of the lamp.

Great care should also be taken that the wick be perfectly dried before immersion in the oil:—an omission on this point gives rise to the continual formation of carbonaceous lumps on the wick's surface, most injurious to the development of a good blowpipe flame. The best material for yielding a clear, powerful flame is unquestionably tallow, and, accordingly, most artisans who have to use the table blowpipe for long periods together generally employ it.

In the laboratory, however, where the use of the instrument is generally extemporaneous, and of short continuance, there is a practical inconvenience attendant upon the use of tallow, viz., some time must be devoted to liquefying it before the wick will yield a satisfactory flame. Hence oil is generally substituted, and it will always be desirable to use for this purpose the best sperm. Common olive, or rapeseed, or poppy oil may be employed, but the flame yielded by either of these is considerably inferior in power to that yielded by oils or fats of animal origin.

Having now provided for the lamp and its fittings, we will direct our attention to the bellows. Relative to this part of the apparatus the chief thing to be said is, that it should be adequately supplied with weights on the upper board to afford the desired amount of air, without the necessity of expanding the leather so much that a direct forcing action shall be applied to the air by the limit of further expansion being attained, which would produce a harsh, irregular flame, unadapted to the necessities of the case.

There is one exception, however to this rule, namely, when a harsh, irregular, brush-like flame is required for the space of a few seconds in the operation of melting a large expanse of glass, preparatory to the formation of a bulb.

All these preliminaries being arranged, the learner may sit down and commence his first lesson. As tools he will require the following:—A pair of surgeon's or watchmaker's forceps, a good file, a pair of scissors, the stem of a tobacco-pipe, and some pieces of hard wood about the size of a quill, and seven or eight inches long. He should also have some pieces of waste glass rods or tubes, to serve, when joined to the glass to be worked on, for handles. For all ordinary occasions these tools will be enough.

Let the young operator, therefore, take his seat, trim his lamp, light it, and endeavour to obtain a good flame. Even the operation of lighting so large a wick as that we have described requires a few comments. If paper be used on an unprepared wick, the latter will necessarily be covered by the charred residue of the former. If a match be employed, the wick will be soiled by brimstone; if a candle be used, the wick will become covered with tallow. If the lamp be raised to the flame of a candle the oil will run out. Thus,—ridiculous though the matter seems,—the means of setting fire to the wick are not so palpable. The plan to be pursued is as follows:—Smear the wick's surface with oil of turpentine by means of a feather, and then approach to it a bit of lighted paper. Thus prepared, the ignition is so instantaneous that the paper may be removed before time has been given for the deposition of any carbonaceous residue upon the wick. For the space of a second, a high, smoky, pyramid of flame,—due to the burning of the oil of turpentine,—ascends; presently, however, it settles down into a less vivid blaze, solely due to the combustion of the tallow or oil. The wick should now be compactly squeezed together by means of the two iron wires, then parted, the middle in such a manner that an uninterrupted stream of air may pass from one end of the wick to the other without coming in contact with any long filament of cotton, which invariably produces a broken, smoky, hissing flame. Nothing but practice can enable the operator to learn the best elevation of the wick, the best distance above the wick surface to project the blast, the most effective strength of this blast, or the most eligible relation between the beak of the jet and the exterior of the flame. As a general rule, however, it may be remarked, that the air should be made to skim over the cotton as near as possible without touching it, and that for most purposes the jet should be thrust some distance into the flame.

Before endeavouring to bend, blow, or seal glass, the operator should learn to produce a good jet, and to be able to have it always under command. The jet may be considered good when it manifests the following appearances:—It should consist of two distinct parts, an interior and an exterior, differing not merely in appearances, but also in regard to their chemical qualities. The interior flame should consist of a lambent blue tongue gradually tapering away to a point, and enveloped by a reddish-yellow haze of incandescence similar in form to the blue flame, which it envelops as a sheath, and beyond which it is considerably prolonged. No part of the flame, either blue or red, should be tinged by dirty streaks of imperfectly-burned volatile matters.

If this kind of flame be not at first produced, the failure may depend (1) either on too great length of wick; (2) too great distance between the jet and the flame; or (3) between the current of air and the surface of the cotton,—conditions which if altered the desired result will be obtained.

However adroitly the jet of air may be applied, there will be generally a portion of flame that is incapable of being thrown into the cone, and which burns as though no blast were applied. This appearance should not be heeded: it is generally coexistent with a very beautiful jet, which once formed and maintained, the operator's object is fully gained. The interior, or blue, flame will seldom be used in any glass blowing, bending, or closing operations. Not only is the heat there produced so great that the glass liquefies to an undue degree, but, in consequence of this portion of the flame containing a portion of hydrogenous and carbonaceous unburned material, it exercises a deoxidizing agency, and hence, if the glass contain any oxide of lead, the oxygen becomes removed, the metal reduced, and a black stain found. This occurrence, indeed, is one of the most frequent to which the young manipulator with the table blowpipe is subjected. The external reddish, hazy flame is the one of greatest utility: its temperature just suffices to produce and maintain the pasty consistence necessary to the working of glass, whilst, in virtue of its oxidizing agency, no black stains from reduced lead result. Whilst on the subject of dark-coloured stains to which glass during exposure to blowpipe heat is subject in the hands of young beginners, we must mention that occasionally they depend, not on any reduction of metallic oxide, but upon the deposition externally of a black carbonaceous crust. In the latter case, the deposition, if very thick, may be wiped off, at least partially; but, as this operation is apt to break the tube subjected to it, a better plan consists in dissipating the carbon by holding the stained tube in the exterior or oxidizing flame. In more experienced hands no such deposition will ever occur. These spots, or stains, become of serious consequence in pieces of glass apparatus through the sides of which chemical changes involving metallic crusts are to be observed. Thus, in prosecuting the reduction test for arsenious acid, numerous experimenters have confounded the spots caused by the blowpipe flame with a coating of metallic arsenic.

When the spirit-lamp is employed for blowpipe purposes, the resulting flame is by no means well defined, and, in consequence of the hydrogenous combustible matter present in the flame, a reduction of oxide of lead into metallic lead is easily effected. It is difficult, therefore, so to manage a spirit-lamp flame that glass con-

taining oxide of lead shall not beeome a little cloudy.

THE ELECTRIC LIGHT.

When the first furor about the electric light was at its highest pitch of intensity, we were amongst the first to comment, we believe justly and impartially—certainly not inimically—upon the difficulties which Mr. Staite had laboured hard to overcome. We spoke in terms of such commendation, as long and successful scientific investigations pursued by the patentee, of the ingenious means by which he had made the supply of electric force self-regulating, and thus had partially overcome the great difficulties under which previous experimenters had laboured in adapting the electric light to a practical use, warranted us in doing. As to the much-agitated question of expense, we did not, even on that occasion, give an opinion, being actuated by the determination of not checking, even by inference, the public ardour with which a patent was ushered into existence.

Had it suited the patentee's scheme of diplomacy, it would have been most satisfactory to ourselves, no less than to others, to have had some indication of the line of testimony necessary to prove that the electric light was more economical than gas; and that some new form of battery would accomplish an avoidance of that intermittent light, which is a difficulty that in none of his exhibitions has the patentee yet perfectly mastered.

Although a demonstration of these two propositions would have been, we say, very desirable, yet it was not difficult to assume circumstances which might render it impolitic, and we were content to await the inventor's time.

It is not a pleasing task for us now to advert to a lecture delivered by the patentee on the 18th instant at the Westminster Literary and Scientific Institution, during which, we are constrained to own, Mr. Staite dealt most unfairly with the public, in conveying a wrong impression as to the amount of knowledge touching the electric light up to the present time:—"It had been said," remarked the lecturer, "that the electric light was no novelty—that it contained no new feature—indeed, a friend of his (Mr. Staite) had said that he had seen the light forty years ago, but no one could make anything of it; and a celebrated public lecturer,* who was now exhibiting the light, was stating in his lectures, three times a week, that he had shown that light upwards of a thousand times. He (Mr. Staite) would subsequently show what was meant by the electric light of forty years ago, and leave his auditors to judge between the electric spark, and the steady and continuous light he was about to exhibit. With reference to the want of novelty, similar remarks had been applied to the illustrious Watt's improvements in the application of steam as a motive power, as the inventions of Savery and Newcoman were known before; also, to Winsor, on his introduction of gas:—carburetted hydrogen was known before; therefore, there was no novelty in that; so it might be said of all things, as they were merely applications of old principles to produce new effects. As regarded the subject of his lecture, unless the electric light could be made perfectly self-acting and self-regulating, it was useless, either as a signal light, or for illuminating purposes; and was, in truth, the expensive toy it had been designated. Now, the desideratum, he might confidently state, had been accomplished by himself and Mr. Petrie, in a most simple manner." The simple manner we have already detailed in a previous number. It is most ingenious—most creditable to the inventive faculty of the patentee, and deserving, we will add, of more success than has been evidenced by any exhibition we have yet seen. We are willing on this point to accord to the patentees much praise; but how could Mr. Staite, well acquainted as he doubtless must be with the whole history of the electric light—how could he venture to show his audience a piece of ignited wire and call it the electric light of forty years ago? He must have formed a very mean opinion, indeed, of the general chemical acquirements of his audience, or he would not have dared to be so rash. It was a very daring thing, we say, for a gentleman whose theme was light—light in its most brilliant, dazzling aspect—to overshadow the mind of his audience with such a cloud of moral darkness. The bad faith, however, was too palpable. At the conclusion of the lecture a gentleman,—a member of the institution,—complained that Mr. Staite had not fairly exhibited the electric light of forty years ago; he had only shown the heating of a piece of thin wire. Was he aware that in Sir Humphry Davy's experiments a brilliant arc of light, four inches in length, had been exhibited, that, like this light, completely eclipsed all others?

Mr. Staite, in reply, said—"he was, of course, aware of that fact; but it must be borne in mind that Sir Humphry Davy used a battery of 2,000 cells, while he was employing only 44." Then, if Mr. Staite was, *of course*, aware of the fact, he deliberately misrepresented to his audience the electric light of forty years ago. The lecturer's *but* is a sorry reservation which in no way aids him in establishing the position he had assumed. For the present argument it matters nothing what kind of battery Davy used,—the question being whether Davy, by using his 2,000 cells, did or did not effect some kind of electric light further than the ignition of a wire? Mr. Staite admits unhesitatingly the affirmation, and, therefore, lays himself open to an unpleasant charge.

The same gentleman then inquired if Mr. Staite was not using the nitric acid battery? and whether he (Mr. S.) could deny that the light with the use of such batteries was anything else but an expensive toy, as had been stated in the early part of the lecture?

Mr. Staite admitted they were then using the nitric acid battery of Professor Callum, and why they did not use their improved batteries was, for the reason before given, viz., that they could neither use or make known their construction without endangering the validity of their patent.

This explanation is intelligible, and we may possibly hereafter find that the new battery realizes all the expectations which the patentee now entertains. When we have made ourselves acquainted with its construction and agency, probably all doubts as to its superiority will leave our mind. We shall then congratulate Mr. Staite on being the inventor of a powerful battery, as he has been the inventor of a new kind of carbonaceous electrode, and a very ingenious application of electro-magnetic principles in the construction of the regulator; but Mr. Staite egregiously deceives himself and the public in telling them he is the inventor of the electric light.

"He wished it to be understood that their improvements in batteries was the subject of a patent, that would be enrolled on the 14th of January next; and, until then, he had been strongly advised not to make the invention public. Viewing the question, however, with reference to the cost of the electric light as a commercial transaction, he was prepared to say (and he begged this assertion might be thrown in his teeth if he failed), that they (the patentees) would, after the enrolment of their specification, be prepared to supply batteries that would be absolutely remunerative to the parties using the light. He (Mr. Staite) had spent upwards of £5,000 in bringing the light to its present perfection, and he believed that it would be generally acknowledged that it was widely different to the light of forty years ago. He was aware that it would meet with considerable opposition on the part of those interested in the consumption of gas; that he was prepared for. All inventions tending to subvert existing arrangements would meet with every obstruction; but he was firmly convinced, and in this opinion he was borne out by several scientific gentlemen of the highest attainments, that the electric light would prevail."

The patentee adverted to the opposition he expected from the gas monopolists so strongly, that it may not be undesirable for us to state how perfectly free we are from any imputation of acting in obedience to incitements from such quarters, seeing that, on several occasions, we have already exposed in this journal their many abuses,—and that we intend to do so again. It is from motives of justice merely to the public that we have passed these comments—with no malice or ill feeling to the patentee, who will nowhere find a more willing advocate than this journal whenever he shall have really achieved and *demonstrated* the perfection for practical use of the electric light.

* Dr. Bachhoffner.

THE NEW EDUCATIONAL MOVEMENT.

A vast amount of argument has been wielded adverse to, or in favour of, the new scheme of education to be henceforth pursued at Cambridge. The comments on the propriety of this important subject have assumed an air of intensity commensurate with so great an organic change in one of our old universities. Thus, whilst one party contemns the so-called improvements; calling them innovations, puerilities, absurdities;—frothy, uprisings of a revolutionary spirit; and already sees depicted a downfal of the church, the state, the crown,—in close connection with, and consequent on, the introduction of studies so heretical and antichristian as geology, chemistry, political economy, and

the living literature of Europe:—another party,—larger, we believe, as we know it to be more intelligent,—advocates the diametrically opposite doctrine—that neither a profound knowledge of abstract mathematics, nor a profound acquaintance with the authors of classic Greece and Rome, is in itself, exclusively, a fit and proper study for a modern youth.

Many of those who have so strenuously,—nay, fiercely,—contended for and against the new system at Cambridge, might have saved themselves much trouble,—the public press much paper, and society a considerable amount of heavy reading. Cambridge will exercise a far less influence on the new educational movement than either she herself, or her friends, or her enemies imagine. A still deeper influence is at work; not commencing in our universities; amongst youths of mature years, with notions preconceived and usually far too deeply-rooted for alteration there, but in our schools,—the earlier seats of learning, where feelings are moulded and tendencies directed, just as in our universities they should be perfected and confirmed.

Amongst the seminaries which have been foremost in adopting the new educational scheme is that of Mr. I. C. Nesbit, in Kennington-lane, and the Agricultural School of Kimbolton. Of the latter we have heard all that the warmest advocate of an enlightened education could wish; of the former, its metropolitan site has been favourable to our more intimate acquaintance with its system, and its merits.

At the close of the past quarter a public examination was held, in which all the pupils bore testimony to the benefits which Mr. Nesbit's system had conferred upon them; and the successful prize competitors give evidence of a dawning talent which we have no doubt will be largely manifested in future years.

On the subject of an agricultural school or college, specially so called, we entirely agree in opinion with a gentleman who spoke on the occasion adverted to. He said:—

"I should feel that I were unworthy of being my friend's guest on this important occasion if I did not offer two or three remarks upon what I have had the gratification to see and hear this evening. I assure you it has called up many pleasing recollections; and I have reflected with considerable regret that, when I was of the age of these lads, general education had not taken that turn which it now seems to be doing. Then, as my friend Mr. Nesbit says, we were nailed down to Greek, Latin, and mathematics, and had very little time for the acquisition of general knowledge. I think we are exceedingly indebted to those who, like our friends the Messrs. Nesbit, are infusing into our general system of education that species of knowledge which cannot fail to become practically useful in after life. I cannot help congratulating you, as a portion of this great nation, that in one of those higher spheres which we are proud to look up to—for both those who have been members of the universities and those who have not look up to them with respect—I am glad to find that in the University of Cambridge there has lately been an intimation given that the system of education at present existing there is about to be reformed, and that the species of general knowledge which has been adverted to this evening will in future be attended to by those who have to fill the highest positions in this country—(Cheers). Such a fact cannot fail to interest all classes; and I agree with our friend Mr. Nesbit that there is nothing like practical knowledge, knowledge which will be useful in after life, as the basis of general education. I also congratulate Mr. Nesbit on his success in another point of view, namely, in reference to agriculture; a subject in which I feel great interest, having been engaged in it during nearly the whole period of my life. I am glad to perceive that attention is here paid to those sciences which are likely to be beneficial to our rising agriculturists, and I look forward to an improvement in that class quite as great as that which characterizes any other portion of society—(Hear, hear). I have long been of opinion that the only true way of improving agricultural education is by infusing better principles of education into existing schools—(Hear, hear). I know there are those who are very zealous for the establishment of agricultural colleges. I should be sorry to say a word which could in the slightest degree damage any attempt which may be made to improve agricultural education; but, having resided myself for a great many years in the country, I know how our schools are constituted and supported, and I have always been of opinion that the most satisfactory, the most expeditious, and the most certain mode of rapidly increasing the sphere of agricultural knowledge is to endeavour to infuse a better system of teaching into the schools already existing. I really think it would be far more difficult to establish new schools upon better principles than to infuse such principles into those which are already in operation."

Mr. Nesbit was, we believe, the *very first* to introduce a system of analytical chemistry as a portion of school discipline, instead of the scientific Christmas pantomime known as popular lectures. The investigations made by pupils in the Kennington School laboratory, on subjects both agricultural and general, would do credit to institutions of far higher scientific pretensions. On this point, however, our readers shall soon have an opportunity of judging.

COURSE OF BLOWPIPE OPERATIONS.*

In the qualitative analysis of complex substances the blowpipe cannot be dispensed with, because certain bodies, especially several metallic oxides, are thus more easily and accurately recognised than in the humid way, especially upon small quantities. We should not advise to trust exclusively to the blowpipe for the qualitative examination of a substance, especially if it contain several constituent principles. It is true that the operation is more readily successful with less complex compounds, but even then some of the constituent principles, often of an essential nature, may thus be overlooked, because a great many substances do not produce very distinct phenomena when treated in the dry way before the blowpipe; whilst, on the other hand, some substances react so powerfully as to eclipse the reactions of the other bodies.

The operator, however, who is familiar with the use of the blowpipe begins by submitting to its action, if not all substances, at least most of them; and, in order to be sure that he has overlooked nothing, he subsequently proceeds to analyze them in the humid way. Sometimes, however, the experiment is not carried further than the examination with the blowpipe, especially when the object is merely to ascertain the presence of substances which may be detected in this manner. This is frequently the case in analysis for technical purposes. Wherefore I have thought fit to indicate the course to be adopted for the detection of the presence of those constituent bodies which may be accurately recognised by the blowpipe.

I will suppose the reader acquainted with the construction of the blowpipe, its form, and the parts of which it is composed, the apparatus to be used with the blowpipe, and the precaution to be taken whilst using the instrument. All these points have been developed in a complete manner by Berzelius in his treatise on the blowpipe, to which work the reader is referred.

The first operation should take place on very small portions of the substance under examination, and it is only subsequently that the substance is dissolved in the fluxes.

The course to be adopted for the detection of the constituent parts of an unknown substance by means of the blowpipe alone is as follows:—

FIRST OPERATION.

The substance is to be heated in a small glass matras, or in a glass tube sealed at one end. At first only the flame of a small spirit-lamp is applied, the object of this operation being, as I have said, to ascertain whether the substance contains any volatile principles, or whether any organic matter forms part of the compound. The heat is subsequently increased by urging the flame of the spirit-lamp with the blowpipe. The substances which in this operation may be volatilized without decomposition, or after having been decomposed, are principally the following:—

Water may be contained in the substance under examination, either as an essential constituent part or as water of decrepitation. A little experience soon enables the operator to judge, from the quantity which condenses on the cold sides of the tube, whether it is an essential constituent portion of the substance, or whether it is only hygroscopic water. The operator must likewise examine whether the liquid thus obtained has an alkaline or an acid reaction, or behaves like pure water towards litmus-paper. If it have an alkaline reaction it can be owing to nothing else but ammonia, the presence of which may be recognised by the white clouds which a glass rod moistened with muriatic acid will produce when held over the said liquid.

Volatile Acids in the gaseous or liquid state. The acid salts of the acids which, in the pure or in the aqueous state, are volatile, being heated in a small glass matras, by means of the blowpipe or of the flame of the spirit-lamp, lose the excess of acid, which then strongly reddens blue litmus paper previously moistened and introduced into the neck of the matras. A few only of the neutral salts of these volatile acids are decomposed when thus heated in a small glass flask; such is especially the case with a great number of neutral nitrates, which fill up the flask with red fumes of nitrous acid. It is safe to treat the nitrates by bisulphate of potash, in the manner which will be indicated further on, because, when thus treated, they all react in the manner just alluded to. The acids of the hyposulphates and hyposulphites are likewise decomposed when these salts are heated in the small glass flask, and may be recognised as such by the odour of sulphurous acid evolved. In a few cases hydrofluoric acid may likewise be expelled from the combinations of fluorine, by the application of heat alone; such is the case when the compound contains at the same time a little water.

Sulphur and some Metallic Sulphurets.—From the substance under examination a sublimate of sulphur may take place when this body is either merely in a state of mixture, or when the substance contains metallic sulphurets which are susceptible of abandoning part of their sulphur when heated out of the contact of the air. In this case the sulphur sublimes in the form of drops, which are reddish-brown whilst hot, but which, on cooling, assume the characteristic yellow colour of sulphur. The metallic sulphurets, which, being treated in this manner, are reduced by the loss of part of this sulphur into a lower degree of sulphuration, have been enumerated, but there are several others which may lose a certain quantity of their sulphur, which condenses on the cold sides of the tube or small flask, because, when thus heated, it is impossible to shelter them altogether from the contact of the air; in consequence of which the oxygen of the air expels a small portion of the sulphur which they contain. The number of the metallic sulphurets which sublime without decomposition is

* From Normandy's Translation of Rose's Chemistry.

very inconsiderable, and is limited to sulphuret of mercury, which acquires a red colour by trituration, and the sulphurets of arsenic, which might be easily mistaken by an inexperienced operator for pure sulphur; but the presence of arsenic may be easily detected therein by the methods which have been indicated.

Selenium and some Metallic Seleniurets.—Selenium may be sublimed in the same circumstances as sulphur, either because some selenium is actually mixed with the substance, or because the latter contains metallic seleniurets rich in selenium. The selenium condenses in small quantity under the form of a reddish sublimate; if in more considerable quantity the sublimate has a black colour, but yields a deep red powder by trituration, and which may be recognised by the odour of its fumes, &c. Amongst the metallic seleniurets, those of mercury and of arsenic are volatilizable, yet the latter undergoes slight decomposition during the experiment.

Volatile Metals.—They are principally arsenic, mercury, cadmium, tellurium, all of which have a metallic lustre and a black or grey colour.

Arsenic sublimes both when it forms an essential portion of the substance under examination, and when this substance consists of metallic arseniurets, containing a large quantity of arsenic, and susceptible of being converted by heat into less arsenietted arseniurets, or into arseniurets in which the arsenic has only a weak affinity for the other metal. Among the first of this class we may name the alloys of arsenic with nickel (arsenical nickel), with cobalt (grey cobalt), with iron, &c. The alloys of arsenic with antimony may be named as examples of the second class. A few arsenites yield likewise metallic arsenic when heated out of the contact of the air. It is exceedingly easy to detect the presence of the most minute traces of a sublimate of metallic arsenic.

Mercury may be sublimed from most of its compounds, and it is more easily identified than any other metal. If the quantity be inconsiderable, it often yields a grey sublimate only, but in which globules of mercury may be distinctly rendered apparent by touching it with a rod of glass or of wood.

Cadmium may be sublimed from some of its alloys, and is recognised by several of its properties, especially because, when heated in contact with the air, it is converted into brownish-yellow oxide of cadmium.

Tellurium is more difficultly volatilizable; heated in a small glass flask, a bright red heat is required to sublime it, and it condenses on the cold sides of the tube or flask in the form of small metallic drops, which resemble those of mercury, except that they are solid.

Volatile Solid Acids and Oxides.—The following belong to this class:—Oxide of antimony, which first fuses into a yellow liquid, and then sublimes under the form of shining crystalline needles; tellurious acid, which behaves nearly like the above, but is much more difficultly volatilizable, and which yields a sublimate, but which is not crystalline; arsenious acid, which is very easily sublimed; arsenic acid, which is converted by a strong heat into oxygen gas and arsenious acid, and then yields the same sublimate as arsenious acid; osmic acid, which, being heated, sublimes in the form of small white drops, with disengagement of a strong, pungent odour.

Volatile Salts.—The ammoniacal salts belong to this class, most of which are completely volatilized, or which sublime only partially when they contain a fixed acid. The ammoniacal salts may easily be distinguished from other salts by mixing them with soda, adding water to the mixture so as to form a pasty mass, and exposing it to a gentle heat upon a piece of platinum foil, by which means a strong odour of ammonia is evolved.

Among the haloïd salts we must particularly mention the perchloride of mercury (corrosive sublimate), which begins to melt at a very gentle heat, and then sublimes; the subchloride of mercury (calomel), which sublimes without previous fusion, and thus yields a sublimate which has a yellowish tinge whilst hot, but is white after perfect cooling. The two chlorides of mercury, like all the combinations of this metal, generally yield a sublimate of mercurial globules when mixed with soda, and then heated in a small glass flask or tube. The compounds of bromine and of iodine with mercury behave nearly like the chlorides of that metal, except that iodide of mercury, which is red, yields a yellow sublimate, which, however, becomes red by trituration.

Although we may not discover any volatile principles in a substance which we intend to analyze, yet it is frequently necessary to heat it in a small glass tube or flask in the flame of a spirit-lamp, when it strongly decrepitates, because this decrepitation might subsequently interfere with the operations to which this substance may ulteriorly be subjected. The substances which thus strongly decrepitate are generally anhydrous salts, and likewise many minerals found in nature, and amongst them certain metallic sulphurets and their compounds.

In some cases, after having thus heated the substance in question, it is to be treated with several reagents, without removing it from the small glass tube or flask. This is done, as may be guessed from the preceding details, when it is suspected that it contains a combination of mercury. It is then to be mixed with an excess of well-dried soda, heated first in the flame of the spirit-lamp, and the heat is subsequently increased by urging the flame with the blowpipe. If the substance contain a combination of mercury, a grey coating of sublimed mercury will be formed. It sometimes happens that this grey coating cannot be immediately recognised as metallic mercury, in which case the operator is obliged to agglomerate the particles a little by touching it with a glass or a wooden rod, which renders the globules of mercury easily visible. If the substance contained water, or if the soda employed was not well dried, water is volatilized at the same time, which condenses in small drops on the cold sides of the tube, and which, subsequently flowing in the form of large drops, may break the tube; it is therefore advisable to heat the soda in a small crucible immediately before the experiment, in order to expel the water it might contain; it is likewise advisable to hold the tube as horizontally as possible. If the substance in question is a very volatile combination of mercury, for example, a combination of mercury with chlorine or with bromine, it may happen, especially if the heat be unskilfully managed, that the greatest part or almost the whole of that substance will volatilize before the soda has had time to decompose it, so that little or no sublimate of mercury is obtained; in such cases it is better that the soda employed be not altogether free from water, and not to heat the mixture in the flask or tube slowly, but, on the contrary, to apply suddenly, if possible, a strong heat; but even then a portion of the combination is sublimed without having been decomposed. This inconvenience can be obviated only by moistening the mixture in the small flask or tube with water, and leaving it at rest for a few minutes before applying heat; but by acting in this manner it is very difficult to avoid the breaking of the vessel whilst heating it.

The only other reagent besides soda which is resorted to in these experiments is bisulphate of potash. It is used for the purpose of recognising the acids contained in the salts after they have been separated from their bases by fusing these salts with this reagent. It is employed especially for the purpose of ascertaining the presence of nitric acid in all nitrates. The nitrates are to be mixed with some bisulphate of potash, and the mixture being introduced in a small glass flask or tube is to be heated in the flame of a spirit-lamp, without the help of the blowpipe, by which means a disengagement of thick red fumes of nitrous acid is produced. The same process is employed to expel hydrofluoric acid from the combinations of fluorine, the presence of which is detected because it corrodes the neck of the flask or the inside of the tube. The combinations of iodine heated in the some manner with bisulphate of potash yield violet fumes of iodine, and a black sublimate of iodine condenses on the cold sides of the tube, sulphurous acid being at the same time disengaged. The combinations of bromine treated in the same manner exhale also gaseous bromine, but generally in such small quantity that it does not constitute a conclusive test of the presence of bromine in such compounds.

In order to detect the presence of sulphuric acid in sulphates having a metallic oxide for a base, the salt must first be deprived of the water which it may contain; it is then to be mixed with pulverized charcoal, and the mixture, being introduced in a small flask or tube, is to be heated by the blowpipe, by which means a strong odour of sulphurous acid will be evolved.

SECOND OPERATION.

After having treated the substance under examination in a small glass flask or tube closed at one end, as mentioned in the first operation, it is to be heated in a glass tube open at both ends (and held in an inclined position), first in the flame of the spirit-lamp alone, and then in the same flame urged by the blast of the blowpipe. The object of this operation is to ascertain whether the substance being thus heated in a current of atmospheric air will yield any volatile matter. During this treatment the operator may increase or diminish the current of air through the tube, for, if it be held in quite a horizontal position, the current of air is almost null; but it becomes more and more active as the tube is held more and more vertically.

The volatile bodies which are produced whilst roasting the substance under examination in a current of atmospheric air escape at times in the form of gases, which their odour may serve to recognise; at other times in the form of a sublimate, which condenses on the cold sides of the tube, and at a more or less considerable distance from the ignited substance, according to the greater or less degree of volatility.

CULTIVATION OF WHEAT IN INDIA.

A correspondent under the name INDO-PHILUS sends the following interesting communication to the *Times*:—

"A ship having just brought a cargo of wheat from Bombay to London, the opportunity seems favourable for making some observations on what may prove a subject of interest to some of your readers. In the first place, India is considered by many to be so completely a rice-producing country as to be thought incapable of growing wheat, barley, or any of our ordinary European grains. This idea has, no doubt, arisen from our having first become acquainted with the southern parts of that extensive empire. A foreigner touching on the western or northern coasts of the British Isles might, in the same way, infer that potatoes or oats were the ordinary diet of the inhabitants. It is forgotten, or perhaps not generally known, that almost every part of India has the advantage of two annual harvests. The one sown about June, or at the beginning of the rainy season, is reaped at its conclusion. It consists of rice, Indian corn, joar—the 'durra' of the Arabs, several millets, among others that called Italian millet, numerous pulses, more nearly allied to haricot beans than to anything else known in this country. The spring, or dry season, harvest is sown in October, when the rains have ceased, and is reaped in February or March. The crops consist of wheat, barley, and common millet. Some Europeans cultivate oats. Beans, peas, lentils, chick pea and pigeon pea are also cultivated, with other pulses of the genus Phaseolus, the same to which the French bean belongs. There are, therefore, a great variety of cereals and pulses for food, and some can be spared for export.

"Wheat is by many considered specially a produce of Europe, but we are indebted for this,

as for many other plants, to the East. It is probably a native of the elevated region which stretches from Affghanistan to the Caspian, as it was cultivated by the earliest civilized nations. Its Hebrew name, Chittah, is considered to be the same as the Arabic Hintch, and similar, in sound at least, to the English wheat. From the elevated Persian region this plant has travelled north into Europe, and south into India, where it can only be cultivated in the cold weather months, but is so very largely.

"The Agricultural Society of India petitioned Parliament in the year 1843 for the privilege of sending wheat to Great Britain on the same terms as had already been conceded to Canada. The society ascertained, from inquiries circulated among its members, that wheat could be landed in Calcutta at from 1 rupee to 2 rupees 12 annas per maund of 82 lbs. from different parts of the Bengal presidency; the cheapest being from the lower provinces, not only on account of their vicinity, but also from the cultivation being cheaper in consequence of the facility of irrigation from the returning inundations, especially on the banks of rivers. The greater dearness of the north-western provinces, where wheat is the principal object of cultivation, is due not only to the greater distance and to the inhabitants themselves being large consumers of wheat, but also to the cultivation being more expensive in consequence of the occasional necessity for irrigating from wells. Canal irrigation would much diminish this source of expense. Mr. Speede, of Calcutta, states the average price of wheat in Calcutta during twelve months to be 1r. 13a. 4p. This, which included the various profits of native merchants and brokers between the grower and the shipper, he deduced from actual sales of the best qualities, which alone were exported. The grain is dearest in September and October, or about the period of sowing the seed, and cheapest in March, when the crop has just been harvested. Taking the average price at 1r. 13a. 4p. per maund, and the rupee at 2s. (it is now only 1s. 9d.), then the price will be about 3s. 6d. for a maund of 82.28 lbs. The average weight of a bushel of wheat being 60 lbs., then about six maunds will be required to make up a quarter of wheat, which will thus, on an average, cost about 21s. in Calcutta. The freight may be taken at £5 per ton, and, as about five quarters of grain go to a ton, then we must add 20s. for the freight, and not less than 9s. for profit, insurance, shipping charges, &c. The cost of Indian wheat in England will thus be at least 50s., roughly calculated.

"When Dr. Burns cultivated some wheat at Broach, as a Government experiment, and sent it to Liverpool, the expenses incurred were about 56s. per quarter. Loss was sustained, partly because some of the wheat became damaged. But he calculated that in ordinary seasons it might be landed at Liverpool for 40s. a quarter. Mr. Speede thinks that it might be sent from Calcutta for 33s., but it does not appear that freight can be calculated lower than I have done. Even from Odessa the freight, a short time since, was 11s. 7d. per quarter, and the price of wheat from 30s. 6d. to 34s 6d. per quarter on board ship.

"It is not probable that much wheat can ever be brought to this country in ordinary years, from the great distance, and the difficulty with which it can be preserved in a sound state, or free from weevil; though I believe this may be done with care. But there is one point to which Colonel Sykes has already drawn attention, and which, in seasons of scarcity, will be one of great importance, and that is, that wheat and barley are ripened in January and February, that is, at least five or six months before those of England are available, so that they might reach this country before that even by the route of the Cape of Good Hope.

"The quality of some of these Indian wheats will probably surprise some of your readers. The kind called doodya is thought highly of, as grown near Patna, and the bread of Chunar and of Benares is celebrated among Indians for its whiteness, &c.; but it is only when articles of commerce are examined by experienced brokers that we are assured of their superiority over similar produce from other places. In June, 1847, two kinds of wheat, which were then four years old, were shown to an experienced cornfactor. He immediately pronounced them to be of fine quality, and valued the soft kind at 90s. and the hard at 80s. the quarter. Colonel Ouseley, the officer in charge of the south-west frontier of Bengal, learning this, procured some fresh specimens of these wheats from the Nerbudda, and sent them to Calcutta, and thence by the overland route to England; but, though reaped in January, they did not reach this before the end of September. Their superior quality has astonished many of the best judges. The white soft wheat was considered by some to be Talavera wheat, but to be unusually fine and of an especially excellent colour. It was valued in the beginning of November at from 66s. to 68s. per quarter, being the most valuable for a miller's purposes. This was several shillings above the highest-priced wheat then in the English market. Its whiteness it owes to the excess of starch, which makes it softer, and thus more easily attacked by weevils, of which it contained a few; but even in this state it weighed 64 lbs. to the bushel. The other kind of wheat, called Julalya, is a hard wheat, and therefore not liked by millers, as it wears down their mill-stones. It was valued not higher than 60s. to 62s. Such wheat requires more help from others of a softer nature in grinding, and is sometimes steamed; but this very hardness seems to enable it to travel better, as this has arrived in excellent order, and weighs 63½ lbs. to the bushel. Indeed, the sample which is now five years old looks as well as ever. It is curious that this hard wheat is more highly esteemed by the natives of India, and they give a higher price for it because they consider it more nutritious. So, in the south of Europe, the hard wheats sell better than the soft wheats, being the best adapted for making maccaroni and vermicelli, as the Indian kinds are for making soojee. These peculiarities of the hard wheats are due to the presence of a larger proportion of gluten and of the other flesh-producing principles. This explains why the natives of India, who grind their own wheat and bake their own bread, find it more nutritious, and it justifies them in giving a higher price for it than for the beautiful soft wheat. Colonel Ouseley states, that in the valley of the Nerbudda the above soft wheat sells at 3 rupees for 400 lbs., while the hard wheat fetches 4¼ rupees for the same quantity. At Saugor the average price of wheat is from 5s. 6d. to 7s. 6d a quarter. The smaller cereal grains are everywhere much cheaper than wheat, so that the native of India, with his low wages, is able to obtain a comparatively larger proportion of the 'staff of life.' From the early ripening of these Indian wheats, I believe it would be possible, in most years, to get some here before the home crops were in the market, and this, in a year of scarcity, would be a great advantage to the consumers, and no doubt also to the importers; but the rivers of Bengal are, unfortunately, becoming dry as the wheat is becoming ripe. Saugor and the Nerbudda are far inland. Improved communications of a more rapid nature are therefore essential for both countries to derive the full advantages of local peculiarities. The increased demand would no doubt raise the price in India, but increased cultivation would bring it down again. Improved culture and the interchange of seed would, moreover, increase the returns per acre, which now vary from twenty to fifty bushels.

"While considering the import of wheat into this country, the occasion may be taken of alluding to the numerous small grains and pulses which India produces, and upon which its inhabitants subsist. Though smaller, they are probably not on that account less nutritious; for four farthings make a penny as perfectly as two halfpence. But as prejudice would no doubt prevent their being employed as food for the people here, in the same manner that rice and Indian corn are objected to, they might be employed as food for cattle, pigs, and fowls, and thus release some of the other cereals as food for man."

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON DEC. 27, 1848 :—				
In London and vicinity, viz. :—				
Battersea	1			
Wandsworth	3	1		
Bromley St. Leonard's	1	1		
In the country, viz. :—				
Holyhead	1			
Berwick-upon-Tweed	10	7	3	
In Scotland, viz. :—				
Haddington (from Nov. 18 to Dec. 23)	30	10	12	8
Moffatt	2	1		
Jedburgh	1			
Bo'ness	1	1		
Dumfries	1	1		
Campbeltown	1	..	1	
Eastwood (Dec. 25th and 26th)	3			
Maxwelltown	..	3		
Old Kilpatrick	2	4		
Edinburgh	2	3	3	
Dumbarton (Dec. 25th and 26th)	9	4		
Glasgow	84	45	21	
Hoddam by Ecclefechan	1	1		
Total new cases	153	82	40	8
In London and vicinity	528	268	100	160
In the country	287	148	39	100
In Scotland	2922	1356	426	1140
Total	3737	1772	565	1400

GENERAL BILLS OF MORTALITY.

The Registrar-General's return of the births and deaths registered in the metropolis during the week ending on Saturday last gives the number of deaths as 1,118, being 36 below the weekly average of the last five years. Of these 331 were from zymotic diseases, being 61 above the average. Of sporadic diseases the deaths were, from dropsy, cancer, and other diseases of uncertain or varible seat, 46, being 6 below the average; tubercular diseases, 163, being 21 below the average; diseases of the brain and nerves, 113, being 14 below the average; diseases of the heart and bloodvessels, 29, being 9 below the average; disease of the lungs and organs of respiration, 177, being 45 below the average; diseases of the stomach and organs of digestion, 57, being 10 below the average; diseases of the kidneys, 14, being 2 above the average; childbirth, &c., 11, being 3 below the average; rheumatism and diseases of the bones, 10, being 2 above the average; premature birth, 38, being 15 above the average; atrophy, 29, being 10 above the average; age, 39, being 25 below the average; sudden, 12, being the exact average of the last five years; violence, privation, cold, and intemperance, 44, being 12 above the average. The deaths from smallpox were 30, or 11 above the average; from measles, 14, or 30 below the average; scarlatina, 110, being 63 above the average; hooping-cough, 42, or 8 above the average; diarrhœa, 15, being 6 below the average; cholera, 31, or 30 above the average; typhus, 46, or 4 below the average; consumption, 113, being 21 below the average; bronchitis,

68, or 7 above the average; and pneumonia, 83, being 31 below the average.

The deaths from cholera registered between the week ending Sept. 23 and Saturday last, a period of three months, have been 449, of which 265 occurred on the south side of the Thames. In the last five weeks, however, the greatest number of deaths has occurred in the eastern districts of the metropolis.

Subjoined is a statement of the fatal cases of cholera registered in the week ending on Saturday last. Seven are cases in which inquests were held; the remainder are all certified by medical attendants:—

Chelsea; South.—M. 6, "malignant cholera (26 hours)." F. 26, "malignant cholera (10 hours)."

Chelsea; North West.—M. 20, "malignant cholera (26 hours)."—Inquest.

Westminster; St. John the Evangelist.—At 2, Grosvenor-street, Millbank, a private watchman, 37, "neglected diarrhœa (14 days), cholera (34 hours)." At 3, Pump-court, Perkins-rents, Great Peter-street, a labourer, 60, "cholera Asiatica (12 hours)." Mr. Pearse, the registrar, states, with reference to the former case, that "the disease was no doubt induced by the nature of the employment of deceased, which frequently deprived him of necessary rest for several days together, and by his very intemperate habits. He was subject to repeated attacks of diarrhœa, which like the present were usually neglected. With respect to the second case, the deceased was not visited by a medical man until two hours before death. His occupation was that of pulling down old houses. Previously to the attack his health had been good, and his habits perfectly sober; but his living had been very low, from poverty, for many weeks, and his house was situated in a locality which had been repeatedly reported as without drainage, sufficient supply of water, cleanliness, and pure air. A boneboiler and tallowmelter's establishment is in the immediate vicinity, and the owner of the premises now lies dead from colica biliosa." St. Margaret.—M. 44, prisoner in Westminster House of Correction, of no profession, "Asiatic cholera—found in his cell apparently labouring under diarrhœa; died in about six hours."—Inquest.

Paneras; Camden-town.—Wife of a porter, 29, "cholera (3 days.)" Mr. Holl states, that "the circumstances of deceased were moderately good; she was attacked on Sunday, the 17th, prematurely confined next day, and died on the 19th. She had suffered from diarrhœa about a week before, which was attributed to eating sprats for supper."

Clerkenwell; Pentonville.—M. 41, "Asiatic cholera (14½ hours.)" Mr. Pyne, the registrar, states that "the deceased had been drinking a large quantity of common intermediate beer, and living in a small and badly-ventilated room with a large family of children, where very bad smells often rise from a drain supposed to run under the room. The sewerage of Pentonville, especially Chapel-street and Warren-street, is very bad. Mr. Butler, the medical attendant of the above case, has informed me that he has attended a very great number of cases of typhus and other fevers, many of which he attributes to the bad drainage of the houses."

Bethnal-green; Town.—At 26, Artillery-street, Waterloo-town, F., dressmaker, 25, "English cholera (3 days)."

Whitechapel; Church.—In London Hospital, M. 19, "Asiatic cholera (24 hours); hemorrhage (2 days)."—Goodman's-fields.—At 5, Swallow's-gardens, Rosemary-lane, M. 14, "cholera Asiatica (2½ days)." Aldgate.—At 8, Slater's-court, Blue Anchor-yard, F. 12, "Asiatic cholera." At 5, Slater's-court, in the same yard, F. 5, "Asiatic cholera (6 days)." At 10, Slater's-court, in the same yard, F. 5, "cholera." At 8, Glasshouse-street, Rosemary-lane, F. 64, "Asiatic cholera (24 hours)." Mr. Harris, the registrar, states that "the court is very unhealthy, and one of the worst in his large district, the inhabitants being of the lowest order of Irish, and very filthy. Several cases which occurred in the same neighbourhood have been taken to the workhouse and London Hospital, not in this district."

Stepney, Limehouse.—F. 28, "cholera (2 days); consecutive fever (6 days)." Shadwell and Wapping.—M. 4, "cholera (4 days)."

Poplar: Poplar.—M. 45, "diarrhœa (3 days; cholera (3 days)."—Bow and Bromley.—At Old Ford, Bow, M. 22, "natural death from cholera (2 days)."—Inquest. At Grove-hall Asylum, F. 30, "natural death, sudden, after attack of cholera."—Inquest. At 6, Frederick-street, Bromley, F. 3, "natural death, sudden, from cholera (9½ hours)."—Inquest. At the same house, F. 31, "sudden death from cholera (12 hours)."—Inquest. Mr. Dunston, the registrar, states, that "both cases occurred in a house situated in a street of the most filthy description. The house contains four small rooms, each inhabited by a different family, the occupants amounting in all to 24 persons, chiefly Irish. Most of the cholera cases of this parish have occurred in this street." F. 29, "natural death, sudden, from spasmodic cholera (14 hours)."—Inquest. "This occurred in Dyer's-lane, Bromley, another filthy place, having a collection of small houses, and no thoroughfare."

St. George, Southwark; Borough-road.—M. 3, "diarrhœa (3 days); Asiatic cholera (9 hours);" M. 5, "Asiatic cholera (30 hours)."

Lambeth; Church, 1st part.—M. 42, "cholera Asiatica (30 hours)."

Wandsworth, &c.; Wandsworth.—M. 2, "Asiatic cholera (8 hours)." Battersea.—At the Union Workhouse, gardener, 50, "Asiatic cholera (48 hours);" in the same workhouse, widow, 44, "malignant cholera (3 days)."

PROGRESS OF CHOLERA IN BELFAST.

The *Belfast Chronicle* states its regret that cholera is making progress in that town, and there seems now every probability of its continuing for some time to come. In the union workhouse two cases occurred on Saturday and one on Tuesday, one of the two terminating fatally, and in the Frederick-street Hospital a man died of this virulent disease on Saturday evening. This man, whose name was Alexander Gardner, arrived there from Glasgow on that morning by the Thetis steamer. He had been ill during the passage, and exhibited all the symptoms of cholera, and a medical gentleman of this town being on board paid him much attention, and administered such remedies as could be had. On the arrival of the vessel he was immediately removed to the hospital, and everything done that medical skill could provide to alleviate his sufferings, but without effect, as he rapidly sank, and died at eight o'clock the same evening. This poor man had been residing at Dundine, a village near Glasgow, where cholera is very prevalent, and came over here in search of employment as a bleacher, in which business he was formerly engaged at Drumbridge. He has left a wife and five children, who are now in the Belfast workhouse, and it is not unlikely that they will all be seized with this disease, one of the children being attacked, and now lying in a dangerous state. The board of health are using the most energetic measures to meet this calamity. The following is the official return made up to Tuesday night:—

"RETURN OF CASES OF CHOLERA.

—	Remaining at last report.	Since attacked.	Died.	Remaining under treatment.
From commencement till 23d ..	..	15	11	4
From 23d till 24th.	4	4	2	6
Total.....	4	19	13	10"

Cholera in Glasgow.—We regret to state, reports the *Scottish Guardian*, that cholera since our last has been on the increase here, extending itself over the city, without regard to advantages of locality or other mitigating circumstances. The total number of new cases and deaths reported since our last (Tuesday's) notice are, 256 new cases, and 108 deaths, viz., on Tuesday, 69 new cases and 30 deaths; on Wednesday, 100 new cases and 50 deaths; and yesterday, 87 new cases, and 27 deaths. Two or three cases have occurred in the upper circles, but for the most part the disease has been confined to the lower classes. Upon a reference to the returns published in 1832, from the month of February, when the disease appeared in Glasgow, up till August, when it began to abate in virulence, we find the following to be the highest numbers of cases reported in each month, viz.—On the 26th of February, 22 new cases; on the 25th of March, 33 new cases; on the 17th of April, 21 new cases; on the 3d of May, 12 new cases; on the 24th of June, 25 new cases; on the 31st of July, 70 new cases; and on the 4th of August, 119 new cases. The disease finally disappeared about the beginning of November. Of course our population has increased since the year 1832 by somewhere about 100,000; but it will be observed that, after the existence of the disease in this neighbourhood for only about one month, the cases reported on Wednesday are only nineteen fewer than they were when the disease was at its height in 1832. Since the above was written, struck with the alarming progress of the disease, we have made special inquiry, and find that in the return for Wednesday are included two or three days' cases at Maryhill not previously reported; so that, in fact, yesterday's return may be said to exhibit the greatest amount of cases in what may be called the city proper. In addition, the return for August, 1832, does not include the cases in the Barony parish, only officially reported a month or two previously, and which, if added, would make the highest total in any day of any month of that year, 181 cases.

Cholera in Liverpool.—According to the *Liverpool Mercury*, there have been several cases of cholera in Liverpool, and all the patients have died, or are in a likely way to die, with two exceptions.

MISCELLANEA.

Receipes for Pomatum.—Common Pomatum: Take 7lbs. of fresh mutton suet, skinned and shredded very fine; melt it in about two quarts of spring water, and, whilst hot, put the whole into a well-glazed earthen pan small at bottom and wide at top. Let it stand till the fat is quite cold and all the impurities fall to the bottom, which carefully scrape off. Then break the fat into small pieces, and put them in a pan with two gallons of spring water for a whole day, stirring and washing often. Next day change the water, and, when poured off, dry the fat by rubbing it on a linen cloth. Then put the suet with 1½lb. of fresh hogslard into a large pan, and melt the whole over a gentle fire. When properly combined put the whole into an earthen pan, and beat it with a wooden spatula till cold. Whilst beating add 6 oz. of essence of lemon-peel, and 30 drops of oil of cloves, previously mixed together. Continue beating till the mixture be perfectly white, and then put it in small pots. Leave them open till it is quite cold, and then cover them with bits of bladder. English or Hard Pomatum: Take 6 drachms of common pomatum, and add to it two or three ounces of very clean white wax scraped very fine. Melt the whole together in an earthen pan, which is immersed in a larger one containing boiling water, over a clear and steady fire. When properly incorporated, take it off and keep stirring it with a spatula, until it be about half cold or congealed, and then put it into small pots as before directed, or make it up into rolls of the size of the little finger. This poma-

tum may be seented with whatever agreeable flavour the perfumer pleases. It will keep good, even with less wax than has been above direeted, in the East Indies or any other warm elimate for a long time. Or, Melt together 1lb. of prepared suet and 3 oz. of white wax, and seent it before it is eold. Italian or Soft Pomatum: Take 25lbs. of hogslard, 8lbs. of mutton suet, 6 oz. of oil of bergamot, 4 oz. of essence of lemons, ½ oz. of oil of lavender, and ¼ oz. of oil of rosemary. These ingredients are to be combined in the same manner as those for English pomatum, and kept in pots for use. Or, mix 3 oz. of oil of almonds with ½ lb. of hard pomatum. Palm or Orange Pomatum: Take 5lbs. of hogslard, 1lb. of mutton suet, 3 oz. of eau de Portugal, ½ oz. of essenee of bergamot, 4 oz. of yellow wax, and ½ lb. of palm oil. Mix as directed for hard pomatuu, and put it into small gallipots, whieh must be well eovered. Another way is to melt in a water-bath the quantity required of eommon pomatum, and add an equal weight of fresh orange-flowers. Let the whole remain for four hours, when it is to be passed through a linen eloth by pressure. Put this with a fresh quantity of the flowers again into the water-bath, and eontinue to repeat the proeess in this manner for five or six times, when it may be set aside to cool, and in fifteen days remelted in the water-bath and put into pots. Parisian Pomatum: Put into a proper vessel 2½lbs. of prepared hogslard, with 2lbs. of pieked lavender-flowers, orange-flowers, jasmine, buds of sweet-briar, or any other sweet-seented flower, or a mixture according to your choiee, and knead the whole with the hands into a paste as uniform as possible. Put this mixture into a pewter, tin, or stone pot, and eork it tight. Place the vessel in a vapour-bath, and let it stand in it six hours, at the expiration of which time strain the mixture through a eoarse linen eloth by means of a press. Now throw away the flowers whieh you have used as being useless, pour the melted lard back into the same pot, and add 4lbs. of fresh lavender-flowers. Stir the lard and flowers together while the lard is in a liquid state, in order to mix them thoroughly, and repeat the first process. Continue to repeat this till you have used about 10lbs. of flowers; after having separated the pomatum from the refuse of the flowers, set it in a cool plaee to eongeal, pour off the reddish-brown liquor or juiee extracted from the flowers, wash the pomatum in several waters, stirring it about with a wooden spatula to separate any remaining watery particles, till the last water remains perfeetly colourless. Then melt the pomatum in a vapour-bath, and let it stand in it about one hour, in a vessel well eorked, and then leave it in the vessel to eongeal. Repeat this last operation till the watery partieles are entirely extracted, when the wax must be added, and the pomatum melted for the last time in a vapour-bath, in a vessel elosely eorked, and suffered to eongeal as before. When properly prepared it may be filled into pots, tying the mouths of them over with wet bladder, to prevent the air from penetrating. This pomatum will be very fragrant, and form an excellent preparation for improving the gloss and luxurianee of the hair. Rose, Rosemary, and other Scented Pomatums are made by adding perfumes to eommon pomatum. Sultana Pomatum is made by balm of Mecea, spermaceti, and eold-drawn oil of almonds. It is used as a eosmetie for the faee for removing freekles, pimples, &e.

Fleet Ditch.—From a paragragh in the London papers it appears (remarks the *Builder*) that about ten or more people, residing at Gillingham, in Kent, have fallen vietims to the Asiatic eholera. Their residenees were on the banks of a creek, continually being stirred up by the tides. Now, at the last visit of the eholera to London more genuine eases oeeurred on the line of the Fleet ditch than in any other part of the metropolis; and it does seem to us that the attention of the eommissioners of sewers might be humanely direeted to that abomination, the existence of which (nearly wholly uneovered from Peter-street to Ray-street, Clerkenwell, a distanee of 1,000 feet) is not known to the publie in general.

An Useful Parachute.—The aseent and deseent into mines and coal-pits, and to ascend by means of vertieal ladders, are operations so fatiguing that the pitmen prefer, in spite of the regulations which forbid it, to expose their lives to the risk of the strength of a rope, whieh, unfortunately, often breaks and preeipitates them to the bottom. An experiment on a large scale was lately made in Belgium which demonstrated, in the most efficient manner, that heneeforth this danger no longer exists. By means of an extremely simple apparatus, the buekct remains suspended in the middle of the shaft when the rope breaks. This trial was not made by means of a working model, but in a pit of some depth; the apparatus being worked by men who remained suspended in the well when the rope broke short off. For the future the parachute for eoal-pits is no longer a theory; its efficaey is now established by praetical facts. The effeet of this apparatus was shown before a numerous eompany, eomprised of men of information, the greater part familiar with the working of mines. Their satisfaetion was so great that they spontaneously offered to the inventor to make affidavit on the spot of the facts to which they had been witnesses. Amongst the party was a gentleman who wished the experiment to be tried upon himself; the rope having snapped, he and the workman aecompanying him were spontaneously stayed without feeling the slightest shock. We shall not fail to aequaint our readers of the new applieations which will not fail to be made of this invention, doubly interesting, whether looked upon in a human point of view or as a matter of economy in the working of mines.

Curious Produce from a Mine.—In the eourse of a mining case tried by Mr. Justice Erle, a number of old and not very brilliant witnesses were examined to prove the extent and mode of working the mine. The following dialogue took plaee between one of them and Mr. James, the barrister engaged for the prisoner:—Mr. James: "Now, you say you work at the mine?" Witness: "Ees, sir."—Mr. James: "How did you work?" Witness: "Why, it wos woorked oop and down, you 'no—this way, that way, 'tother way, foot-ridden way—dang it, every way"—(Laughter). Mr. James: "I must eonfess I don't understand you." Witness: "I think I spoke plain enuf"—(Loud laughter).—Mr. James: "No doubt you did, but the stupidity is on my side, not on yours." Witness: "That's it. You are quoit stupid—(Roars of laughter). You conna' onderstand English!"—(Continued laughter.)—The Judge: "If we had been in the habit of working in mines, doubtless your language would have been perfeetly intelligible, but as it is we eannot understand you." Witness: "Well, I eonna' spake any plainer. Dang me, if ever I sced such stupid people since I left pit." Some further attempts were made by the learned eounsel to obtain a more definite answer to the question, but it was "no go," and the witness was at length told to leave the box.—*Liverpool Times.*

Ornamental Masonry.—In England ornamental masonry (states the *Builder*) appears to have been carried on longest in Derbyshire, which eounty is singularly rich in mineral productions. The objeets originally made of spar were urns, vases, eolumns, and obelisks; but generally they were solid lumps of stone, and from their great weight most ineonvenient to move about. But later works, besides being eopies of the most approved forms of the antique, are manufaetured very thin and light, so that a taper plaeed within displays the most extraordinary and riehest eolours in the mineral world. Apart from its splendid veins and hues, this substanee is valuable from its being peeuliar to this eountry. A prodigal waste of this stone was onee earried on when abundanee eould be obtained from the mine, but now it is extremely scaree and expensive, the price having risen from £14 to £60 per ton.

Liquid Blue.—Put into a small matras, or phial, 1 oz. of fine percyanide of iron (prussian blue), reduced to powder, and pour over it from ½ oz. to 2 oz. of eoneentrated hydroehlorie aeid. The mixture produces an effervescenee, and the percyanide soon assumes the eonsistenee of thin paste. Leave it in this state for twenty-four hours, then dilute it with 8 oz. or 9 oz. of water, and preserve the eolour thus diluted in a bottle well stopped. The intensity of this colour may be lessened, if necessary, by the addition of water. If the whole of this mixture be poured into a quart of water, it will still exhibit a eolour suffieiently dark, for washing prints. This eolour, charged with its mordant, requires the use of gum-water made of gum tragacanth. Mucilage of gum arabie does not possess sufficient consistence.

Common Rouge.—(1.) Pound in a pint of good brandy ½ oz. of benzoin, 1 oz. of red sandal-wood, ½ oz. of Brazil-wood and roek alum; then put them into red wine, which boil till it is redueed to one fourth part. To make use of it employ eotton. (2) Take ½ oz. of red sandal-wood redueed to powder, ½ oz. of cloves, and 5lbs. of sweet almonds. Pound the whole together. Upon this paste pour 2 oz. of white wine, and 1½ oz. of rose-water. Stir the whole well every day. In about eight or nine days a very good red oil will be obtained.

Carmine Rouge.—To prepare earmine, boil 1 oz. or 2 oz. of eochineal, finely powdered, in eleven or twelve pints of rain-water in a tinned eopper vessel for three minutes; then add 25 drachms of alum, and eontinue the boiling for two minutes longer, and let it cool; draw off the elear liquor as soon as it is only blood-warm very carefully into shallow vessels, and put them by, laying a sheet of paper over eaeh of them, to keep out the dust, for a eouple of days, by which time the earmine will have settled. In case the earmine does not separate properly, a few drops of a solution of sulphate of iron will throw it down immediately. The water being drawn off, the carmine is dried in a warm stove; the first eoarse sediment serves to make Florenee lake; the water drawn off is liquid rouge.

Cinnamon Cordial.—Take 2 dwts. of oil of eassia dissolved with sugar in 1½ gallon of spirit of wine, and 1 oz. of husked eardamom-seeds, and 1 oz. each of lemon and orange peel dried. Fine with half a pint of alum-water, and sweeten with about 2lbs. of loaf sugar; make up the two gallons with water, and eolour with burnt sugar. If it be required very strong, digest and distil 8lbs. of bruised einnamon from 17 gallons of spirits of wine, and 2 gallons of water. Draw off 18 gallons with a strong heat.

Pearl Water.—A cosmetic eelebrated for the removal of freckles. Put ½lb. of the best Spanish oil soap, cut or seraped very fine, into 1 gallon of boiling soft water; stir the whole well, and let it stand till eold; then add 1 quart of rectified spirit of wine, and ½ oz. of oil of rosemary, and mix it thoroughly.

Bismuth Pearl-Powder.—A eelebrated eosmetic. Take 4 oz. of the whitest and driest trisnitrate of bismuth, and 2 oz. of fine stareh powder; mix them well together, and put them into a subsiding glass, which is wide at the top and narrow at the bottom. Then pour over them a pint and a half of proof spirits, and shake and stir the whole well; after which let them remain together, to subside for a day or two. When all the powder has fallen to the bottom, pour off the spirit from it quite dry; and then place the glass in the heat of the sun, in order to evaporate any remaining moisture. Then turn out the white mass, whieh will be in the shape of a eone; all the dirty parts, if any, forming the top or small end, whieh are to be earefully scraped off, and the remaining part of the eake is to be again pulverized, and to have more proof spirit poured over it. Now proceed in all respects as before; and, if there be any moisture remaining a second time, the eone is to be plaeed on a large piece of chalk, made very smooth, to absorb all its moisture. Now eover the whole with a bell-glass, to preserve the compound from dust and dirt, and

set it in the heat of the sun, which, if it be very hot, will soon dry and whiten it. After this grind the mass with a muller on a marble stone; and keep the powder in a glass bottle, having a ground stopper, free from any communication with external air.

To Clean Kid Gloves.—Lay them flat on white paper, or, still better, fix them on a wooden hand, then with a flannel dipped in pure oil of turpentine (lamp naphtha) rub until the dirt is removed. Rub partially dry by means of flannel, then keep in a hot room before the fire until the smell of turpentine is dissipated. Essence of lemons may be used instead of turpentine, but is more expensive.

Presence of Nitric Acid in Hail.—It is known that rain which falls during a thunderstorm frequently contains a little nitric acid, the origin of which is attributed to the combustion of nitrogen by the lightning. M. Dueros ("Journ de Pharm. et de Chim.," vi., 273) has proved by experiment that certain hailstones, which had a piquant taste, not only contained nitric acid, but minute portions of nitrate of potash.

To Purify Nitric Acid.—M. Barreswill has indicated ("Journ. für. pr. Chim., xxv., p. 255) that to purify nitric acid, containing hydrochloric acid, redistillation only is necessary, when the hydrochloric acid passes first with a little nitric acid, and constitutes a mixture which, according to the proportion of hydrochloric acid present, may equal the one eighth or one fourth of the acid employed, and which may serve for operations in which the hydrochlorie acid produces no injurious effects. In another receipient is then collected the pure acid, which subsequently distils over. "I have often tried," remarks Berzelius, "many years ago, to prepare pure nitrie acid by this easy method, and have obtained a result of which some drops did not produce any turbidity in nitrate of silver, but on throwing some drops of nitrate of silver into half an ounce of the acid, the mixture soon beeame opaline." Dr. Wackenroder has made the same observation. Thus the operation to be useful must be conducted with great care.

Hyposulphite of Soda is thus prepared by Capaun's process:—Boil a dilute solution of caustic soda with sulphur until saturated; then transmit sulphurous aeid gas through the solution until there remains but a very small portion of Na S_5 undecomposed, which may be ascertained by filtering a small portion of the solution, which ought to have a very pale yellow colour. The whole of the solution is next filtered and evaporated by boiling to a syrupy consistence. The air during evaporation acts upon the Na S_5 whieh remains in the liquor, and converts it into hyposulphite of soda, which crystallizes from the syrupy solution. When the salt is dry it is unalterable in the air. If there still remains some sulphuret of sodium in the syrup, with a view to its removal, it is simply necessary to mix it with one half of its weight of alcohol, and shake it well. The alcohol takes up the sulphuret of sodium, and swims on the surface of the aqueous solution, which latter is set aside to crystallize, without removing the supernatant alcoholic layer. Berzelius thinks that "it would be more advantageous to modify this operation in sueh a manner as to procure the bisulphite by saturating a solution of carbonate of soda with sulphurous acid gas, disengaged from bruised eharcoal by sulphurie acid. Then to mix with this solution (of bisulphite soda) the sulphuret of sodium, prepared in the moist way above mentioned, in slight exeess; filter, evaporate, and crystallize."

Argentan (German Silver).—This alloy is composed of eopper, zine, and nickel; 8 parts of copper are used in combination with $3\frac{1}{2}$ of zinc, of which latter metal one half volatilizes during fusion. If 2 parts of nickel be now added, an alloy is obtained of yellowish-white colour, constituting an inferior article. With 3 parts of nickel the metal acquires the aspect of silver. It is this which is most generally used. With 6 parts of nickel the alloy possesses the aspect of fine silver, having the exact bluish-white appearance on being well polished. These last proportions are rarely employed, either because the alloy is too infusible, or because nickel ordinarily contains arsenic, in whieh case it is too brittle for general utility.—(For details see *Revue Scientif. et Indust.*, xxi., 159.)

Paste of Dates.—Take of dates 1½lb., water 30 pints; boil, clarify, add washed gum senegal 6lbs., dissolve; add white sugar 5lbs., evaporate without boiling to the eonsistence of a thick honey. Stir in orange-flower-water 9 oz., and again gently evaporate; pour it into moulds, finish the drying by a gentle heat in a stove, and then divide it.

Paté de Guimauve, or Marshmallow Paste, is employed as a cough remedy on the Continent, and is thus made:—Take decorticated marshmallow-root 4 ounces; water ½ gallon. Macerate for twelve hours, and strain; then add refined sugar, and gum arabic, of each 1 pound. Dissolve, strain, evaporate to the consistence of honey, stirring all the time; and then add the whites of twelve eggs well beat up with orange-flower-water. Continue the evaporation till it is so firm that it no longer sticks to the fingers; then form into moulds.

Odoriferous Essence.—A celebrated perfume. Take of China musk and balsam of Peru of each 11 grains, civet and oil of cloves of each 5 grains, oil of rhodium 2 grains, salt of tartar 30 grains, alcohol 2 ounces. Macerate for a fortnight, then pour off the supernatant portion. Or, take oil of rhodium and balsam of peru of each ½ drachm, oil of cloves 1 drachm, spirit of ammonia ¼ oz., essence of civet 2 oz., essence of musk 5 oz., oil of neroli, of lavender, cassia, and verbena 5 drops of each. Mix, dissolve, and filter.

Essence of Roses.—Take otto of roses ¼ oz. very strong spirit of wine 1 quart. Put into a close vessel, cork, and agitate, aiding the mixture by slight warmth. This is best done by putting it into a bath of warm water. As soon as the vessel is warmed through take it from the fire, and shake until cold. Add a tablespoonful of calcined magnesia, shake well, and filter through paper.

TO CORRESPONDENTS.

We have received numerous letters expressive of thanks for our advocacy of a more remunerative salary and a better social position for medical and pharmaceutical assistants. Having broached the topic, we will not fail to lend our advocacy towards its abolition, but the assistants must aid us by their co-operation, without which a journalist cannot effect much good.

"A Correspondent," in reference to the suicide of a druggist's assistant mentioned by us last week, addresses to us the following letter:—"Sir,—As a chemical assistant, starving on £18 a year, I thank you cordially for your making known the case of poor Bellamy, who committed suicide by prussic acid. Believe me, sir, the fashionable firms are amongst the most grinding and cruel to their assistants, and not least so the firm most intimately concerned in the above melancholy suicide. God only knows what the result might have been if Bellamy had been better paid."

"Mr. N. Beswick."—The liquid glue manufactured by Neuber we have tried, and find most valuable. Its smell is not at all disagreeable, and its cohesive power only comparable to that of diamond cement.

"Mr. Frederic Muspratt," who wrote to us about a fortnight since, requesting that we would forward the series of papers on "Soda Ash" published some time since in the *Pharmaceutical Times*, shall have the journals forwarded.

"Mr. Pearson."—It has been proved by many experimenters, and lately by Bouchardat and by Dr. Ayres, that preparations of iron and lead are very injurious to vegetation when admixed with the soil.

"Mrs. Roof" asks us the use of warming the teapot, and pouring away the water previous to putting in the tea, and if the tea when so put in should be allowed to *draw* with a little hot water, or whether the teapot should be filled up at once. The teapot is warmed because a certain amount of heat is necessary to the perfect extraction of the active part of the tea, which heat the teapot will *steal* from the hot water with which the tea is made, if it have not been previously given to it. Tea should not be allowed to draw, as it is called, but the pot should be filled at once; the object being to expose the leaves to the maximum heat of boiling water for the maximum time, short of applying more heat. These conditions are at variance with the drawing or soaking system.

"A Perfumer."—All hair dyes are injurious to the hair.

"Mr. P. Nicholls"—Emery was long regarded as an ore of iron. It is very abundant in the island of Naxos, at Cape Emeri, whence it is largely imported. It is found also in the islands of Jersey, Guernsey, at Almaden in Spain, in Poland, Saxony, Sweden, Persia, and many other countries. It consists of alumina, silica, and oxide of iron.

"Mr. H. Crocker."—We shall be very happy to assist you. Do not fear troubling us. To direct youthful genius is pleasing to us.

"Mr. John Brown" shall receive a communication from us.

"Mr. Nesbit's communication has been received.

"Mr. George Williams" shall hear from us shortly. Great press of occupation is our excuse for keeping him thus long without an answer.

"Amicus."—The party you mention does not stand well.

"Mr. G. Renshaw."—Apply to Messrs. Poole and Carpmall, 4, Old-court, Lincoln's-inn-fields.

"Mr. J. Mortimer."—Litmus is prepared in Holland from the Lecanora tartarea roccila tartarea, by a secret proccess, but which, without doubt, is similar to that for making archil and cudbear. The lichens reduced to powder are first treated with a mixture of urine and potash, and fermentation is induced, the result of which is a purple red-coloured material. The coloured liquid is now treated with more lime and urine, and again set to ferment for a period of three weeks, after which it is mixed with chalk or gypsum into a paste, made into little cubes, and dried.

"Mr. J. Hendries."—The beautiful ruby colour now frequently given to glass is effected by oxide of gold. The proportion of the oxide should be, however, very small, and the heat very great, or the effect is not produced. The presence in the glass also of oxide of lead, bismuth, zinc, or antimony is necessary, for the gold imparts no colour to crown glass, nay, sometimes even in conjunction with the other metals the colour does not appear until the glass has been exposed to a red heat.

"Mr. James Peters."—Cochrane's Cough Medicine is prepared by just making a decoction of the heads of white poppies previously freed from the seeds. Let this be strained; boil it again with vinegar and brown sugar to the consistence of syrup; then add sulphuric acid till it is rather sour.

"Mr. James Norton."—Confection of oranges is thus made:—Take 1 pound of the fresh rind of the orange, procured by rasping; 3 pounds of white sugar. Bruise the rind in a stone mortar with a wooden pestle; then, the sugar being added, bruise again, until they are properly incorporated. It is injured by keeping.

"A Pharmacopolist."—Guaiacum is adulterated with manchineel gum, which may be detected by dissolving some of the suspected gum in proof spirit, adding a few drops of sweet spirit of nitre, and diluting it with water, when the guaiac will be precipitated, and the manchineel will float. When it is adulterated with common resins the fraud will be discovered by the smell emitted during burning.

"Mr. John Davies."—Black lozenges are thus made:—Form a smooth mucilage with 1 pound of gum tragacanth, in powder; add 10 ounces of lump sugar, powdered; and then 10 ounces of extract of liquorice. Put in a warm place, and stir till ready.

"Vermis."—Nouffleur's Receipt for Worms was purchased from Madame Nouffleur by Louis XV. for a large sum of money, and published. It is as follows:—Powder very finely, for one dose, 3 ounces of the male fern, Aspidium filix mas, and, after the patient has been prepared the previous night by an emollient clyster, and a supper of panada, this is to be taken early in the morning, fasting; two hours after a bolus is to be given made with 12 grains each of chloride of mercury and scammony, and 5 grains of gamboge. This, as Dr. Good remarks, will probably kill either the tapeworm or the patient!

"Hedvig" must by no means employ the bichloride of mercury; it is a most deadly poison, and has produced death even when used as a lotion.

"A Young Chemist."—Absolutely pure hydrogen gas is said to be without smell. It is very difficult, however, to obtain it in this condition.

"A Schoolboy."—Carbonic oxide is best made by heating crystallized oxalic and sulphuric acid together. Crystallized oxalic acid is composed of carbonic oxide, carbonic acid, and water. The sulphuric acid takes away the water, and liberates the two gases, the latter of which may be absorbed by agitation with cream of lime.

"M. G." may depend on receiving articles of absolute purity from the manufacturer he mentions.

"Mr. T. Jackson."—Professor Highschool is still in London, at his old institution in the West Strand.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office No. 49, Essex-street, in the parish of St. Clement Danes and at 320, Strand, in the City of Westminster,—December 30, 1848.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,*
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XXXIX.

(LECTURE LXVII.)

EXTRACTS—(*Continued*).

2. EVAPORATION WITH FREE ACCESS OF AIR.

Upon this principle of free access of air extractive liquors may be evaporated by either of the following five processes :—

A.

The liquid may be evaporated in dishes plaeed in a stove heated to between 97° and 104° Fahrenheit.

It is essential for the success of the operation, 1, that there be a free current of air through that part of the stove where the dishes are placed; and, 2, that the layer of liquid in the dishes be sufficiently thin to ensure its evaporation to dryness within twenty-four, or, to the utmost, thirty-six, hours.

It has been objected to this process that it tends to alter the extractive liquors, and also that the extracts prepared by it will not keep for any length of time. However, the first of these objections holds good only if the operator ehooses to neglect one of the most essential rules, viz., that the liquid should be evaporated in thin layers, so that it need not be kept in the stove beyond twenty-four, or, to the utmost, thirty-six, hours. And, as regards the second objection, the experience of several years has taught me that extracts *properly* prepared by this proeess will keep very well, provided always the pots or jars in which they are put away be closely and securely covered.

This process is resorted to more particularly for the evaporation of non-depurated vegetable juices, and also for the preparation of the dry extracts. In the former case the evaporation should be earried nearly to dryness; after the removal of the dishes from the stove the extract speedily absorbs moisture from the air, and gets soon sufficiently soft again to permit its removal from the dishes. With regard to the preparation of dry extracts, the best way is to evaporate the liquor first to the consistence of a syrup, spread this in thin and uniform layers on china dishes, and evaporate to dryness in the stove; remove the extraet now from the dishes in form of thin scales, which may be readily accomplished by means of a sharp square-topped knife u-ed ehisel-fashion. This operation should be eonducted in the stove, or, at all events, in a perfectly dry place. The scales will sometimes fly off to a distance; it is accordingly prudent to place several large sheets of paper around the dishes to facilitate the gathering of the scales.

A more simple and convenient way would be to spread the highly-concentrated extract on tin plates, to heat the latter until the contents are perfectly dry, when the extract may at once be removed by simply bending the plate.

I need hardly mention that the dry extracts require to be kept in perfectly dry glasses or jars.

B.

Place the extract in liquor in a pan over a gentle fire, and stir it continually with a wooden spatula. This process requires no particular apparatus, but it demands the greatest possible care in the execution. The fire should be managed in a way to keep the liquid below the boiling point. This may be readily accomplished by a very simple contrivance, viz., by using a very small stove in comparison to the size of the pan.

C.

M. Henry has introduced at the Central Pharmacy of the Hospitals an apparatus, composed of several double-bottomed basins, heated by steam, and communicating with each other by means of copper pipes.

The steam which circulated freely between the two bottoms served to effect the evaporation of the extractive liquors in the basins.

I have given up the use of this apparatus, because it requires the continual presence of a person to stir the liquid, in order to assist and accelerate the operation.

D.

M. Bernard Desrones has proposed a very ingenious apparatus. This consists of a tin-plated copper tray with raised edges, and which is divided into several imperfect compartments by copper bars plated with tin. This tray has a false bottom, into which the steam of boiling water is conducted.

The tray is placed in a gently inclined position, and the extractive liquor is then poured in at the upper part, from whence it makes its way to the opposite extremity, pursuing slowly the tortuous path pointed out to it by the copper bars. The apparatus is placed in a current of air, and thus, as the liquid, in its slow progress over the heated bottom of the tray, presents a considerable extent of surface, we have here a combination of all the conditions required to expedite the process of evaporation.

Several trays may be joined together. When the liquids have got sufficiently concentrated to impede their progress over the bottom of the tray the operation is achieved in the liquid-bath, in a common pan, and with continual stirring.

The metallic trays of M. Desrones' apparatus are enclosed in wooden trays to keep the external surface from cooling. The steam is furnished by a common boiler.

E.

An excellent way, in my opinion, is to evaporate the extractive liquors in the liquid-bath with incessant stirring. The simple apparatus which I use for the purpose, and which I find answers exceedingly well, consists of a copper pan, into which is closely fitted another pan of tin or tin plated copper.

The larger of the two pans contains water, the other holds the extractive liquor. The water in the larger pan is heated to boiling, and the thereupon ensuing evaporation of the liquid in the smaller pan aided and accelerated by continual stirring. An open tube runs along the side of the smaller pan, to afford a free passage to the steam of the boiling water.

This process is, in my opinion, the most expeditious. The only objection that might be urged against it is, that it imposes upon the operator the tedious task of stirring the liquid without intermission for the space of several hours.

A most objectionable process was formerly much in use, and is even now not unfrequently resorted to. I mean the evaporation of extractive liquors over a free fire and at ebullition heat. Such a proceeding is sure to yield bad extracts.

By whatsoever method the evaporation of extractive liquors may be effected, it is impossible to prevent the formation of a deposit. Besides, the formation of a deposit is frequently the result, not of an alteration of the extractive liquor, but simply of the subtraction of the liquid by the process of evaporation: the diminution of the liquid compels the subsidence or precipitation of certain matters which require a larger proportion of fluid for their solution than the reduced amount continues to afford; it tends also to increase the cohesion of other principles which were in some measure held simply in mechanical suspension by the liquid.

The usual sustom is to remove these deposits when the concentration has been carried to three fourths of its limits, and then to achieve the evaporation. Yet some of these deposits decidedly possess medicinal properties; thus, for instance, the deposit which forms in the extract of guaiacum consists almost exclusively of resin—the only principle in that extract which seems to have some medicinal action.

Extracts contain sometimes salts or resinous matters which will impart to them a grumous aspect, though they may have been prepared most properly. The presence of salts in extracts cannot well be avoided. The only thing that can possibly be done in this respect is to avoid adding any fresh quantity of salt to that naturally present in the juice; distilled or rain water should accordingly be used for the preparation of extracts.

The grumous aspect may also, as I stated just now, be the result of the separation of resinous particles. Parmentier advises to add a few spoonfuls of alcohol of 56 C. to the extract when the evaporation approaches its term. This addition has the effect to diminish the tendency of the resins to separate; the extract appears more uniform, and keeps better.

Most extracts absorb moisture from the air, owing either to the presence of deliquescent salts, or to a power of absorption inherent in the vegetable matter. Extracts should accordingly be kept in perfectly dry places only. It is moreover necessary to inspect them from time to time, to ascertain whether they have undergone any alteration or not.

I keep my extracts in pots tightly closed with good corks. Mr. Redwood advises to fill the pots to the brim, and to cover them with a sheet of tinfoil fixed round the border with sealing-wax.

EXTRACTS PREPARED WITH THE JUICES OF FRUITS.

Extracts prepared with the juices of fruits go often by the name of "*Robs*," or "*inspissated juices*."

The extracts of succulent fruits are mostly prepared with the juice, because the drying of the fruit would be a tedious and difficult operation, attended moreover with increased chances of alteration.

Some of the robs are prepared in an exceedingly simple way: the juice is squeezed out of the fruit, strained through linen, and evaporated to the consistence of thick honey. In this way are prepared, for instance, the robs of gooseberries, belladonna, elaterium, grapes, elder, &c.

In the preparation of inspissated grape juice it is advisable to let the expressed juice stand at rest for a time, in order to permit the separation by crystallization of the larger part of bitartrate of potass which it contains, and which would spoil the extract by its acidity.

In some cases the juice is left to ferment in the fruit previously to its extraction. The fermented juice is then extracted by the action of the press, decanted, and finally evaporated to the consistence of extract.

Some pharmacopœias recommend the addition of sugar to the inspissated juices of fruits.

EXTRACTS PREPARED WITH THE JUICES OF PLANTS.

The following is the most simple way of preparing these extracts :—

Bruise the leaves or stems of plants (as the case may happen to be), squeeze out the juice, strain through a linen cloth, and evaporate the strained liquid in dishes (in thin layers) in a stove heated to from 97 to 104 Fahrenheit. This process, which was recommended first by M. Henry, yields extracts which contain all the principles of the juices such as they existed previously to the evaporation, and retain moreover the odour of the plant from which they have been respectively derived.

In this way are prepared the extracts of

Hemlock,
Belladonna,
Hyoscyamus,
Stramonium,
Lactuca sativa,
Lactuca irrosa,
Aconite,
Anemone,
Rhus radicans.

In the case of plants which owe their medi-

* Dr. Muspratt's Article on Organic Chemistry next week. Dr. Scoffern's on Sugar the week following.

cinal properties to some extractive substance, it will be found advantageous to clarify the juices by heat previously to their evaporation. This process is resorted to, for instance, for the preparation of the extracts of

Succory,
Dandelion,
Fumitory,
Menyanthes trifoliata,
Nettles,
Cochlearia officinalis,
Nasturtium officinale,
Chervil.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

A NEW AND IMPROVED METHOD FOR THE ANALYSIS OF COMPOUNDS IN WHICH THE OXIDES OF IRON AND MANGANESE ALUMINA, AND ALKALINE EARTHS EXIST IN COMBINATION WITH PHOSPHORIC, ARSENIC, AND SILICIC ACID.

By R. FRESENIUS.

I. SEPARATION OF PEROXIDE OF IRON FROM PHOSPHORIC ACID IN THE PRESENCE OF ALKALINE EARTHS.

a. It has been assumed by many chemists (*ex. g.*, Berzelius and Rammelsberg) that by fusing the perphosphate of iron with a carbonated alkali, and exhausting the mass with boiling water, a complete separation of perphosphate of iron and phosphoric acid may be effected. Rose goes further, and states that even when the alkaline earths are present the phosphoric acid goes over altogether to the alkali and becomes dissolved on treatment with water.

I had long since satisfied myself that it was impossible perfectly to decompose phosphate of lime and phosphate of magnesia by carbonate of soda. I have now found that even the peroxide of iron cannot be entirely deprived of phosphoric acid by this process. In truth, if the residue is dissolved, after careful washing, in muriatic acid, precipitated with ammonia and sulphuret of ammonium, filtered, and the solution mixed with chloride of ammonium and sulphate of magnesia, a distinctly appreciable precipitate of ammonio-phosphate of magnesia is always produced. It is thus rendered certain that all methods based upon the above principle are without foundation.

b. When to a muriatic solution, in which phosphoric acid, peroxide of iron, and lime are contained, carbonate of soda is added, and mixed until the free acid is nearly saturated, and then mixed with an excess of acetate of soda and boiled, the whole of the phosphoric acid is precipitated with the peroxide of iron, the lime still remaining in solution. Peroxide of iron and sulphuric acid may then be separated by sulphuret of ammonium. This is a very inconvenient method, though it is not inaccurate. Its inconvenience is aggravated when the quantity of phosphoric acid to be estimated is no more than a mere trace, and the amount of peroxide of iron is at the same time very great, a case which is not uncommon in the analysis of iron ores, soils, &c.

With respect to the other method (see my introduction to Quantitative Analysis) of separating phosphoric acid from peroxide of iron,* I must remark that it has been found to have led to erroneous results, for a mixture of a solution of tartaric acid, sulphate of magnesia, chloride of ammonium, and ammonia will, after a short time, as soon as it has attained a certain degree of density, deposit a crystalline precipitate having exactly the appearance of the ammonio-phosphate of magnesia. Nor has the employment of citric acid, sugar, &c., in place of the tartaric acid, led to more satisfactory results. I therefore base my present method upon an entirely new principle.

c. The solution we will suppose contains much peroxide of iron, lime, and some phosphoric acid. We first heat the solution to the boiling point, remove it from the lamp, and add a solution of sulphite of soda until the colour is pale green, and a white precipitate is given with carbonate of soda. The solution is then boiled until the smell of the sulphurous acid is appreciable. Any excess of free acid is neutralized with carbonate of soda; a few drops of chlorine-water are mixed with it, and lastly an excess of acetate of soda. The reaction is so sensitive that the smallest quantity of phosphoric acid is immediately detected by the production of a white flocky precipitate of perphosphate of iron.*

[The reaction is so sensitive because the perphosphate of iron is not soluble either in acetic acid or in the acetate of protoxide of iron, whilst it dissolves freely in a solution of the peracetate of iron. It is by virtue of this circumstance that a precipitate is never obtained when a solution of the peroxide of iron, which is nearly neutral, containing only a small amount of phosphoric acid, is mixed with soda; the dark red liquor remains clear at a low temperature, and all the iron, together with the phosphoric acid, is only deposited on heating to 212°.]

Chlorine-water is added slowly until the liquid becomes reddish: it is then invariably turbid. It must now be boiled until it becomes clear, which is soon accomplished, filtered while yet hot, and the precipitate washed with hot water. The whole of the phosphoric acid is contained in this precipitate as perphosphate of iron, mixed with a very small quantity of basic peracetate of iron. Nearly the whole of the iron and the lime are contained in the precipitate: they may be separated without difficulty by means of sulphuret of ammonium. The precipitate, containing the phosphoric acid and lime, may be at once perfectly decomposed by first dissolving it in muriatic acid, and adding ammonia and sulphuret of ammonium. Perfect decomposition may also be effected without the use of sulphuret of ammonium in the following manner:—Dissolve it in muriatic acid, and reduce with sulphite of soda as above, add an excess of caustic potash or soda, boil until the precipitate becomes black and granular, and filter through a very close paper.†

The precipitate thus formed is protoperoxide of iron, free from phosphoric acid; it is to be dissolved in muriatic acid and united with the other solution of iron. The phosphoric acid is contained in the filtered solution, which is precipitated in the usual manner as ammonio-phosphate of magnesia.

II. SEPARATION OF IRON FROM ALUMINA.

The separation of peroxide of iron from alumina by caustic potash is one of the most frequently recurring operations of analytical chemistry, but it is also very inaccurate. It had frequently been noticed that the separation of the two oxides by caustic potash was not complete, and it was with a view to this fact that Knop proposed precipitating the solution with sulphuret of ammonium, and afterwards boiling with caustic potash.

But his method is extremely inconvenient, as, although the liquid is free from iron and yellow at the commencement, it almost invariably passes through green and ferruginous in the washing, no matter whether pure water or that containing sulphuret of ammonium is employed. The inaccuracy of the usual method may be seen from the following experiment:—To a solution of perchloride of iron a solution of chloride of ammonium, containing 1.000 grm. alumina, was added, an excess of caustic soda was mixed with the above, and the whole boiled, filtered hot, the filtrate acidified with muriatic acid, and carefully precipitated with ammonia. When this had stood several hours in a warm place it was filtered. The alumina on the filter was yellow, which led me to suspect the presence of iron, which I afterwards found in it.

Alumina was also found in the hydrated peroxide of iron, for although well washed it gave a precipitate, though a small one, on being boiled again with caustic soda, and on treating the filtrate as above. A loss of ten per cent. took place, for instead of 1.000 grm. alumina only 0.909 were obtained, and these, moreover, contained iron. After standing eight days the filtered solution deposited alumina. The whole of the missing alumina, therefore, had not remained with the iron, but a portion had not been precipitated by ammonia. The cause of this was found after some further experiments. The circumstance on which the loss depends is that on filtering the liquid containing the caustic alkali through paper a portion of organic matter is dissolved, and this prevents precipitation. This fact will be proved by the following experiments:—A solution of pure chloride of aluminum which contained 1.320 grm. alumina was precipitated with potash, the precipitate again dissolved in an excess of potash; the liquid heated to boiling, filtered, acidified with muriatic acid, and precipitated with ammonia. The alumina obtained was only 1.290, or 97.72 per cent. In a second experiment 98.48 per cent. were obtained. To avoid this evil asbestos may be used instead of paper for filtering; but a far better way is to heat the liquid acidified with muriatic acid, and boiling with it a little chlorate of potash (removing the flask from the fire on the addition). By this means we destroy the organic substance preventing the complete precipitation of alumina, as the following experiments show:—A solution containing 0.3420 alumina was treated in the above manner; after being acidified with hydrochloric acid, boiled with chlorate of potash, it yielded 0.3418 alumina, or 99.94 per cent. A second experiment gave 99.67 per cent.

Another source of inaccuracy, which in the first experiment raised the loss of alumina 10 per cent., is the fact that it is impossible to free the hydrated peroxide of iron completely from alumina by caustic potash. This source of error may be avoided without having recourse to Knop's cumbrous method. The acid solution, containing alumina and peroxide of iron, is heated to boiling in a flask, removed from the fire, and reduced with sulphite of soda. The liquid, having been kept boiling for some time, is neutralized with carbonate of soda, an excess of caustic soda is added, and, after being well shaken, it is boiled until the liquid has become black and granular.*

The liquid is now removed from the fire and permitted to subside; the clear liquor is passed through a close filter, and the precipitate washed with hot water, first by decantation and then on the filter. The filtered solution, treated, as above described, with muriatic acid and chlorate of potash, yields the whole of the alumina upon precipitation with ammonia, and after several hours' standing.

III. SEPARATION OF ALUMINA FROM PHOSPHORIC ACID.

In order accurately to analyze a compound containing alumina, oxide of iron, lime, magnesia, and phosphoric acid, it is first of all necessary to separate the alumina from the other bases. This is easily accomplished by precipitating the liquid, after reduction of the peroxide of iron by sulphite of soda, by carbonate of soda, and then boiling with the addition of an excess of caustic soda.

It must here be remembered that, on boiling, the carbonic acid which had been combined with

* This method consists in adding tartaric acid and then ammonia to the solution, and finally a mixed solution of chloride of ammonium and sulphate of magnesia.

* If the solution contains silicic or arsenic acid a precipitate will be formed, although phosphoric acid is not present. These two acids must therefore be first separated, or the phosphoric acid cannot be detected with certainty by the above reaction.

† If the filter is too porous some of the fine precipitate may pass through, especially when washed. When this accident occurs the filtrate must be suffered to stand, the clear liquor must be drawn off, and the remainder be filtered through a separate small filter.

* The thumping which precedes the boiling may be prevented by inserting a coil of platinum wire, and by constant stirring. When the liquid really boils the thumping ceases.

the protoxide of iron passes to the soda and converts it into a carbonate. To retain the alumina in solution, therefore, it is necessary to add caustic soda at intervals, and espceially when the precipitate has become black and granular. In this manner the alumina and a part of the phosphoric acid is obtained in solution, and we now want an easy method of separating the two. Such a method is the following:—First render the alkaline solution acid, boil it with chlorate of potash precipitated with ammonia (avoiding a large excess), and add chloride of barium as long as a precipitate appears; after digesting a while, filter. Collect the precipitate which contains the whole of the alumina and phosphoric acid (the latter combined partly with alumina and partly with baryta) upon a filter, wash it with a little water, and dissolve in the smallest possible quantity of muriatic acid. Saturate the solution with carbonate of baryta, applying heat; add an excess of caustic potash and apply heat. The baryta which may be contained in the solution may be precipitated by carbonate of soda and filtered. All the alumina is now in the solution, and the whole of the phosphoric acid in the precipitate. The solution is now to be rendered acid with muriatic acid, boiled with chlorate of potash, precipitated with ammonia, and set by to stand for some hours in a warm place; the alumina is filtered, dried, washed, and weighed. The precipitate is dissolved in muriatic acid, and the baryta thrown down with weak sulphuric acid, separated by filtration, and the phosphoric estimated as ammonio-phosphate of magnesia as usual.

IV. THE ANALYSIS.

In order to make plain the course of analysis proposed, we will suppose a compound to be analyzed containing a large amount of peroxide of iron, protoxide of manganese, alumina, lime, magnesia, phosphoric acid, sulphuric acid, arsenic acid, silicic acid, and sand, as is the case with iron ores.

A quantity, not too small, of the mineral in fine powder should be weighed and digested with moderately dilute hydrochloric acid in a flask, at a temperature a little below the boiling point, until all the soluble matter is really in solution. The liquid is then diluted, passed through a filter of a determined weight of ash, and the residue washed. The quantity with brown iron ore is very small. This is dried with the filter, separated from it, calcined, and weighed, then transferred to a boiling solution of carbonate of soda, allowed to boil for some time, filtered through the filter first used, washed, dried, calcined, and weighed. The difference between this weight and the one first obtained gives the amount of silicic acid, the insoluble residue.

From the residue the ferruginous muriatic solution is filtered, carefully evaporated to dryness, and maintained for some time at a temperature a little above 212°. After having been gently moistened with muriatic acid, and a gentle heat at the same time kept up with it, water is added, and any silica that may be present is separated by filtration. The weight of this added to that above obtained shows the total amount of silicic acid in combination.

The ferruginous solution is heated to boiling in a flask, and reduced as described in I. with sulphite of soda. After the whole of the sulphurous acid has been expelled by boiling, sulphuretted hydrogen is passed into the solution as far as saturation. The resulting precipitate is the protosulphuret of arsenic. The amount of arsenic which it contains is ascertained after deducting its sulphur, which has already been determined as sulphate of baryta. If the precipitate is brown or black instead of a yellow colour, it probably contains other metallic oxides, and it must be examined for them in the ordinary manner. The liquid filtered from the protosulphuret of arsenic must be boiled to get rid of the whole of the sulphuretted hydrogen, and afterwards precipitated with carbonate of soda, and boiled with excess of caustic soda until the precipitate appears black and in grains. It should then be allowed to subside, the clear liquor be poured off, the precipitate must be washed with hot water by decantation, and finally washed with hot water on a filter of close texture.

a. Treatment of Precipitate.—The precipitate (containing protoperoxide of iron, protocarbonate of manganese, carbonate of magnesia, and phosphate of magnesia) is again placed in the flask, and digested with muriatic acid. When it has stood for some time in a warm place it is entirely dissolved, but not so quickly as the hydrated peroxide of iron. When black particles can no longer be found it is filtered, the filter is left whole, and a little hot water is poured upon it. The flask is so placed that the liquid may run off. This arrangement admits of its being washed with ease and well. Sulphite of soda is employed to reduce the filtered solution, which is then nearly neutralized with carbonate of soda, heated to 212°, mixed with a few drops of chlorine-water, and then with an excess of acetate of soda. When this liquid or the precipitate has not the reddish hue, chlorine-water is added until this appears. The whole is boiled until the precipitate has separated, filtered, and the precipitate, which consists of phosphate and some basic acetate of peroxide of iron, is washed.

After the addition of ammonia, and while still hot, the filtered solution is precipitated with sulphuret of ammonium, quickly filtered, the precipitate, consisting of protosulphuret of iron and manganese, continually washed with hot water, and the lime in solution is determined by oxalate of ammonia, and, after the removal of the oxalate of lime, the magnesia which is thrown down by phosphate of soda. The precipitate of the sulphurets is dissolved in muriatic acid oxidized with chlorate of potash or nitric acid, boiled until all the chlorine is driven off, allowed to cool to about 140°, almost neutralized with carbonate of soda, the peroxide of iron precipitated with carbonate of baryta, and the remaining oxides determined by the usual processes.

The precipitate containing the perphosphate of iron is dissolved with muriatic acid, reduced with sulphite of soda, boiled with an excess of caustic soda, and filtered. The solution containing the phosphoric acid is more than saturated with muriatic acid, and set aside. The precipitate of peroxide of iron is also dissolved in muriatic acid, oxidized with nitric acid, the solution added to the prime solution of iron, separated from the manganese and baryta, and the whole precipitated with ammonia.

b. Treatment of the Filtered Alkaline Solution.—This solution, containing the alumina, is subjected to the treatment described under III. The alumina is, therefore, weighed in a pure state. The solution is united with the above-mentioned liquid, supersaturated with ammonium, and precipitated with sulphate of magnesia; if necessary, chloride of ammonium may be employed in addition. The sulphuric acid in the mineral is estimated in another portion by dissolving it in muriatic acid, filtering the dilute solution, and precipitating with chloride of barium.

I have not considered it necessary to point out in the preceding explanations how much the course of analysis is simplified when one or the other of the substances in question is absent, nor the mode of conducting the quantitative analysis. With respect to the latter I would just remark that the proposed method cannot be deviated from without risk; and, also, that it is of great importance to ascertain the presence or absence of alumina, manganese, and alkaline earths before commencing the qualitative analysis, because, when the alumina is present, the first precipitation with carbonate of soda, as well as the boiling with caustic potash, may be omitted; all the phosphoric acid is contained in the alkaline liquid holding the alumina in solution when no alkaline earths are present, and the residue may be at once treated for the separation of iron from manganese. When no manganese is present it may be at once precipitated with ammonia from the muriatic solution after previous oxidation, calcined, and calculated as peroxide of iron.

In confirmation of the truth of the principles on which this method is based, I prepared a liquid in which were known quantities of peroxide of iron, alumina, lime, magnesia, and phosphoric acid, and divided it into two equal portions, after which I analyzed both, following exactly the foregoing directions. In each half of the liquid were contained:—

	Grms.	Found. I.	Found. II.
Phosphoric acid ..	0.100	0.0993	0.0995
Lime	0.133	0.1328	0.1327
Magnesia	0.103	0.1020	0.1029
Peroxide of iron ..	1.443	1.4426	1.4424
Alumina	0.150	0.1495	0.1495
	1.929	1.9262	1.9270
In 100 parts:—			
Phosphoric acid ...	5.18	5.14	5.16
Lime	6.89	6.88	6.88
Magnesia	5.34	5.29	5.33
Peroxide of iron ..	74.81	74.78	74.77
Alumina	7.78	7.75	7.75
	100.00	99.84	99.89

—*Journ. für Prakt. Chem.*

ON THE ESSENTIAL OIL OF CHAMOMILE.

By M. C. GERHARDT.

Oil of Anthemis nobilis, or chamomile oil, is of a greenish colour, with an agreeable odour, and boils at from 320° to 410°. At the former temperature it first begins to boil, and slowly rises to 374°, at which point its temperature remains stationary for a long time. More than two thirds of the oil passes over at this temperature. After a time the temperature rises to 410°, but no separate oil possessing this boiling point is met with in the residue. The elevation of temperature is attributable to the presence of a resinous substance, for the distilled oil exhibits precisely the same chemical qualities whether taken at the lowest or highest of these temperatures, and are, therefore, composed of the same principles. The boiling points of these principles are so approximated to each other that it is impossible to separate them by distillation. Three portions of the oil were collected between 392 and 410°, and gave the following numbers:—

Carbon.....	75.57	76.61	76.00
Hydrogen ..	10.57	10.66	10.78
Oxygen	13.86	12.73	13.22

The above composition appears to express that of a simple body; but the author afterwards found that the oil had a strong acid reaction, and gave, like the earlier portions, a certain quantity of carburetted hydrogen with potash.

It is well known that potash is often employed with much advantage to separate oxygenated oils from hydrocarbons which are found with them. It was thus that the author prepared the hydrocarbons of the oils of cumin and valerian. The oxygenated principles become acids which combine with the potash, and the hydrocarbon comes over quite pure. Oil of chamomile is not acted on by an aqueous solution of potash, but it concretes into a gelatinous mass if gently heated with powdered hydrate of potash; no gas is disengaged, and the oil is obtained unaltered by water. When, however, this gelatinous mass is heated with an alcoholic solution of potash the oxygenated principle is changed into an acid, and the hydrocarbon is set free. Two acids are formed under these circumstances, the angelicic and valerianic acids.

1. *Angelicic Acid.*—On fusing the oil with an excess of potash the mass swells considerably, in consequence of the disengagement of hydrogen, and a liquid is at the same time condensed, having an agreeable odour very much resembling that of lemons; this consists of an hydrocarbon to which we must presently return. When the potash residue is saturated with sulphuric acid,

corrosive vapours arise akin to those of benzoic acid; these condense into beautiful needles. They are very fusible and quickly crystallize in water; they melt in hot water, and give off acrid vapours on boiling the solution. They yielded to analysis:—

Carbon	59.7	10	60.0
Hydrogen	8.0	8	8.0
Oxygen	32.3	4	32.0

numbers which are equivalent to those which express the composition of the acid extracted by Meyer and Zenner from angelica-root. It is to this that oil of chamomile owes its acidity, and it appears to be formed by the further oxidation of the oxidizing principle.

2. *Valerianic Acid.*—When the oil is boiled for some minutes with potash in an alcoholic solution, all the oxygenated principle enters into combination with the potash, and the alcohol holds in solution only the hydrocarbon described in the next paragraph. This and the alcohol are distilled away, and the residue is decomposed by sulphuric acid: an oily acid is thus separated, which possesses the properties and odour of valerianic acid. But the oily acid thus obtained is often contaminated by the presence of a certain quantity of angelicic acid; this is to be removed by rectifying the oily acid obtained from the potash salt, allowing the liquid scarcely to boil; the angelicic acid is then obtained in the residue, and on cooling it separates in fine needles.

The Hydrocarbon.—We saw in the last paragraph but one that when the oil of chamomile is treated with potash, either solid or in an alcoholic solution, an oil is set free which potash will not affect. In order to obtain this oil perfectly dry it must be rectified over potassium; chloride of calcium dissolves some portion and produces a crystalline compound which is destroyed by water. Where an alcoholic solution of potash has been employed to saponify the oil of chamomile, water must be added to the mixture, so as to separate the oil; the liquid may then be saturated with chloride of calcium and the oil transferred with the pipette.

This oil, when perfectly pure, has a very pleasant odour of lemons, like cymene; its boiling point is also 347°; but the subjoined analysis shows that besides this the two oils have little in common:—

Carbon	87.8
Hydrogen	11.8

The Oxygenated Principle.—It has been already stated that it is not possible to obtain the principle which, when treated with potash, furnishes the angelicic and valerianic acid, in a state of purity. Even the latest-collected portions of the distilled product always contain some hydrocarbon; its composition is, however, indicated with great distinctness by the reactions with potash. The angelicic and valerianic acids contain each an equal amount of carbon, C^{10}, but the former contains two equivalents less of hydrogen than the other; but, as in the formation of potash no gas is disengaged, and as in the formation of the angelicate hydrogen is set free, it follows that the oxygenated principle of the oil of chamomile must contain $C^{10} H^8 O^2$, thus:—

Valerianate of potash, $C^{10} H^8 O^2 + KO + HO = C^{10} H^9 O^3 + KO$.

Angelicate of potash, $C^{10} H^8 O^2 + KO + HO = C^{10} H^7 + KO + H^2$.

It has, moreover, been found that the valerianate is not converted directly, or *per se*, into angelicate. Pure valerianate of potash was fused with an excess of potash at 572°, a temperature much above that at which the angelicate is formed from the oil, but no gas was set free. Moreover, the presence of free angelicic acid in the oil favours the above expression of angelicic acid, $C^{10} H^8 O^2 + O^2$. Another fact is equally corroborative of this view: the hydrocarbon of the oil is $C^{20} H^{16}$ or $C^{10} H^8$, and the free acid in it likewise contains $C^{10} H^8$; we ought, therefore, always to find the same relation, $C^{10} H^8$, in the crude oil of chamomile, whatever may be the proportions of acid, hydrocarbon, and oxygenated oil it may contain, or at whatever stage of distillation it may have been collected. For instance, we find in the three above-mentioned analyses:—

Carbon..... 76.1 : 6 = 12.68 equivs. carbon,
Hydrogen .. 10.6 : 1 = 10.6 " hydrogen,
or 12.68 : 10.6, pretty nearly 10 : 8.

The author on one occasion obtained while rectifying oil of chamomile, containing but a small portion of alcohol, a perfectly blue distillate, whose colour totally disappeared at the end of eight days. Whether the blue oil of matricaria chamomilla and the oil of anthemis nobilis contain the same constituents has not been determined; but it is worthy of remark that Borntraga's analyses of the oil of the common chamomile give the same proportion, $C^{10} H^8$.—*Ann. de Chim. et de Phys.*

REVIEWS.

NOAD'S CHEMISTRY.

Other matters having claimed our immediate attention, we have been obliged to defer until this time a further notice of a book which we have already recommended in terms of commendation,—the "Treatise on Chemistry" by Mr. Noad. We purpose now giving our readers a slight sketch of the arrangement pursued by the author in the execution of this task. The book consists of some 300 pages, illustrated with woodcuts wherever their presence is desirable; and divided into two parts, respectively devoted to qualitative and quantitative chemistry.

In a treatise of this kind faithfulness of narration is paramount to every other quality. A treatise offering imperfect processes for the conducting of chemical analysis would be worse than useless. Such a fault we can aver, from a careful examination of Mr. Noad's book, the author has well avoided, and the result is a treatise on practical chemistry every way worthy of the end proposed,—the instruction of the people.

In this respect, indeed, Mr. Noad's book has everything to gain by comparison with the prototype of Professor Daniell. Deservedly great as this lamented chemist undoubtedly was, his greatness was in no way increased by the style of either his popular lectures or his popular writings. With respect to his labours in regard to the Society for the Diffusion of Useful Knowledge, he was, at least, by no means felicitous. Indeed, a chemist of some note, before whom the original sheets of Daniell's popular treatise were placed for examination, pronounced a very strong adverse opinion upon them, which having been most unwarrantably communicated to Professor Daniell, a temporary coldness was the result. We should not have adverted to this fact, which we can well authenticate, had not a sister journal commented,—we consider most unfairly,—on the relative popular literary merits of Professor Daniell and Mr. Noad. The latter chemist is not so conceited that we may fear to tell him he has many years to live, and much to do, before he achieves the fame of Daniell as a chemist; as a popular writer, however, on chemistry for the Society of Useful Knowledge he has already immeasurably outstripped the former. Had we more space we would desire to present our readers with various specimens of our author's descriptive powers; but we find ourselves constrained to limit these desires to the selection of one very important article, the analysis of the urine:—

"*On the Analysis of Urine and Urinary Calculi.*

"From the following analysis of this important secretion by Berzelius it will be seen that its composition is very complicated; indeed the chemistry of urine is as yet very imperfect, for in no complete analysis which has hitherto been published has any account been taken of the hippuric acid, or the kreatine, or kreatinine, which Liebig has announced to be constant constituents, while, according to the same chemist, normal urine contains no lactic acid; so that in the subjoined analysis the 17.14 parts which are set down to this acid and its salts are, in reality, something else, the nature of which has yet to be discovered.

"*Analysis of Urine by Berzelius.*

Water	933.00
Urea	30.10
Urie acid	1.00
Lactic acid, lactates, and animal matter	17.14
Mucus of the bladder	0.32
Sulphate of potash	3.71
Sulphate of soda	3.16
Phosphate of soda	2.94
Phosphate of ammonia	1.65
Chloride of sodium	4.45
Hydrochlorate of ammonia	1.50
Earthy matters, with a trace of fluoride of calcium	1.00
Silicious earth	0.03
	1000

"Urine may be acid, neutral, or alkaline, even in a healthy condition of the body, its reaction to test paper as well as the nature of the salts which it contains depending in a great measure on the nature of the food, so that the physician has the saline condition of this secretion greatly under his control, a fact of great value in the treatment of calculous diseases. When the food contains salts of potassa and soda with organic acids, the urine becomes alkaline; these acids becoming oxidized in the circulation yield carbonic acid, which combines with the alkalis, and the alkaline carbonates appear in the urine. When the food contains but very little of such salts of organic acids, the urine may be neutral; and when it contains none at all it becomes acid from the solution of uric or hippuric acid, or both, in phosphate of soda.

"The specific gravity of healthy urine may vary from 1.012 to 1.030, and contain about 7 or 8 per cent. of solid matter, the remainder being water. In certain diseases, however, the density of the secretion may be considerably greater, as well as its proportion of solid ingredients. The following table, showing the quantity of solid matter in diabetic urine of different specific gravities between 1.020 and 1.050, was drawn up by Dr. Henry, and, assuming its correctness, Dr. Frampton has given the following simple method of determining, without having recourse to actual experiment, the amount of solid matter voided in a given time in urine of any specific gravity. If Dr. Henry's table be examined, it will be found that there is an increase of solid matter in each wine pint of urine, corresponding to the increase of one degree of specific gravity of exactly 12.2 grains, or of 1.2 grains of solid matter in each ounce for every one degree of specific gravity. Hence, to determine the amount of solid contents in urine, say specific gravity 1.025, we have only to multiply the constant quantity, 1.2 grains, by 25, making 30 grains, to give us the solid contents of one ounce, whose specific gravity is 1.025, and this again by the number of ounces voided in a given time, say 40 ounces (making 1,200 grains), to give us the whole contents of solid matter dissolved in the urine passed in that time. This rule will be found, on trial, to give results so nearly coinciding with those of the table (the error is constantly just 1.6 grains in excess in the wine pint), it is so easy both to recollect and to apply, and so much more convenient than a table not always at hand, that it is well worthy of the notice of medical men.

In the experiments which furnished the following table the urine was evaporated at a steam heat till it ceased to lose weight, and till it left an extract which, on cooling, became quite solid. In reference to such tables Dr. Bence Jones observes that, though they may be true for the total quantity of water passed in twenty-four hours, they are not so for the urine made at any one period of the day. The water made before and after dinner, for instance, may have the same specific gravity, but the total quantity

of solid residue in each case may be entirely different.

"*Dr. Henry's Table of Solid Matter in Urine of different Densities.*

Spec. grav. of the urine, water being 1000.	Quantity of solid extract in a wine pint in grs.	Quantity of solid extract in a wine pint in oz. dr. scr. grs.
1020	382.4	0 6 1 2
1021	401.6	0 6 2 1
1022	420.8	0 7 0 0
1023	440.0	0 7 1 0
1024	459.2	0 7 1 19
1025	478.4	0 7 2 18
1026	497.6	1 0 0 17
1027	516.8	1 0 1 16
1028	536.0	1 0 2 16
1029	555.2	1 1 0 15
1030	574.4	1 1 1 14
1031	593.6	1 1 2 13
1032	612.8	1 2 0 12
1033	632.0	1 2 1 12
1034	651.2	1 2 2 11
1035	670.4	1 3 0 10
1036	689.6	1 3 1 9
1037	708.8	1 3 2 8
1038	728.0	1 4 0 8
1039	747.2	1 4 1 7
1040	766.4	1 4 2 6
1041		
1042	804.8	1 5 1 4
1043		
1044	843.2	1 6 0 3
1045		
1046	881.6	1 6 2 1
1047		
1048	920.0	1 7 1 0
1049		
1050	958.4	1 7 2 15

"It is no part of our plan, neither would it be at all suited to the design of the present work, to give any detailed account of the numerous and important investigations which have been made within the last few years on the urine, both in health and in disease. To the physiologist and pathologist it cannot be doubted that the subject must be one of the highest interest; but it is not to a general treatise on chemical analysis that the cultivator of medical science would refer for such information as he might require in this department of his studies. We have, nevertheless, thought that it might add to the usefulness of our work to bring together some of the later methods which have been adopted by chemists for the detection and quantitative estimation of certain of the ingredients of this complicated secretion.

"*Quantitative Estimation of Urea.*—Two methods have long been in use, viz., separating it as nitrate, and calculating its proportion; or as oxalate, this being subsequently decomposed by carbonate of lime, and the urea weighed in its pure state. Both these methods are fallacious, on account of the solubility of both the salts; the following have therefore been proposed as substitutes.

"1. *Rabsky's Method.*—Concentrated sulphuric acid, in the quantity of half that of the urine used, is added to the latter, and the mixture kept in a moderate state of ebullition; much water is thus vaporized, and the fluid becomes black. The temperature continues to rise, until at about 392° (it should not very much exceed this temperature) carbonic acid is evolved in small bubbles; the cessation of this disengagement of gas indicates that the urea is completely decomposed. The black residue is then thoroughly exhausted with water, and the solution filtered: the clear yellow filtrate is then evaporated in the water-bath, and the generated sulphate of ammonia treated with alcohol and chloride of platinum. Since urine contains salts of potassa and ammonia, which will likewise be precipitated upon the addition of chloride of platinum, their exact proportion must be determined from a separate weighed portion by precipitation with chloride of platinum, and the corresponding amount must be subtracted from the first quantity. The author found this method to give accurate results, which were not interfered with by mixing the urea with sugar previous to analysis: in applying it, however, it is necessary to remove all those substances which might introduce error, such as uric acid, hippuric acid, albumen, &c. In many instances it may be advisable to separate the urea previously by oxalic acid, and to decompose the oxalate subsequently with sulphuric acid. In calculating the amount of urea, one part of ammonio-chloride of platinum corresponds to 0.134498 of urea.

"The conversion of urea into carbonate of ammonia, which also takes place when the urine is left to itself, will be understood from the following equation, in which it is seen that by the addition of the elements of water all its carbon is converted into carbonic acid, and all its nitrogen into ammonia:—

$$\left.\begin{array}{l}1 \text{ equivalent urea } C_2N_2H_4O_2\\ 2 \text{ do. water } H_2O_2\end{array}\right\} = \left\{\begin{array}{l}2 \text{ equivalents carbonic acid } C_2O_2\\ 2 \text{ do. ammonia } N_2H_6\end{array}\right.$$

$$C_2N_2H_8O_4 \qquad C_2N_2H_6O_2$$

The carbonate of ammonia thus formed is of course instantly decomposed in the above experiment by the sulphuric acid, sulphate of ammonia being generated, and carbonic acid set free.

"*Heintz's Method.—Examination of the Potassa and Ammonia.*—A weighed quantity (from 100 to 120 grains) of the urine is treated with about 30 drops of hydrochloric acid, and set aside in a cool place for twenty-four hours; it is then filtered through a very small filter into a large platinum or porcelain crucible; the filter and glass are washed with a small quantity of water; the filtrate is treated with about 100 grains of sulphuric acid, and the liquid evaporated over a small spirit-lamp, taking care that it does not boil, until the evolution of carbonic acid commences. The crucible is then covered with a watch glass, and heated until the evolution of carbonic acid ceases, the temperature not being allowed to exceed 180°. The contents of the crucible are then filtered into a porcelain dish, the crucible and the watch glass are well washed, and the filtrate is evaporated until almost all the water has passed off. About twenty drops of hydrochloric acid are then added to the residue, and afterwards a sufficient quantity of chloride of platinum and alcohol mixed with ether. If the liquid from which the precipitate has subsided is of a very pale colour, more chloride of platinum must be added. After eight or ten hours the precipitate is separated by filtration, washed, dried, and heated to redness in a crucible, which is at first covered, but subsequently open. The residue is treated with boiling dilute hydrochloric acid, the solution filtered, and this is repeated until the liquid which drops from the filter leaves no residue when evaporated upon platinum foil; the crucible and filter are dried at a gentle heat: the latter is burnt in the former, and weighed. Thus the amount of platinum, which corresponds to that of the potassa, ammonia, and urea, is obtained.

"Another weighed quantity of the fresh urine is treated at once with chloride of platinum, three volumes of alcohol and one of ether. At the end of ten or twelve hours the mixture is filtered, and the precipitate heated to redness in a well-covered and weighed platinum crucible. The residue is treated as above with dilute hydrochloric acid, and the filter is burned and weighed. We thus obtain the weight of platinum which corresponds to the potash and ammonia contained in the urine; its per centage is calculated, and then deducted from that obtained in the first experiment: the difference gives the amount of platinum which corresponds to the urea.

"In estimating the urea, if perfect accuracy be not required, the separation of the lithic acid may be avoided: the error hereby introduced amounts to about 0.7 part per 1000, placing the average amount of lithic acid in the urine at 1.0 per 1000. The filtration of the residue after the action of the sulphuric acid may be avoided, and it may be mixed at once with the chloride of platinum, alcohol, and ether.

"The estimation of the amount of potash and ammonia in the urine should not be neglected, as it is liable to considerable variation: the author found it 1.0 to 11.6 parts per 1000. These two alkalis are precipitated together by treating fresh urine with chloride of platinum, alcohol, and ether. To separate them, the yellow precipitate is heated to redness, and the residue repeatedly extracted with boiling dilute hydrochloric acid: the solution is filtered, and the filter burnt. The platinum remaining corresponds to the quantity of ammonia and potash in the urine. On evaporating the filtered liquid with chloride of platinum and alcohol, a precipitate of platino-chloride of potassium is obtained, which is treated as above to estimate the potash it contains.

"*Separation of Albumen.*—To estimate the urea in albuminous urine, a carefully weighed portion is treated with bichloride of mercury and boiled in a capacious dish. The liquid is then filtered, the precipitate slightly broken up and washed with water. When this is perfectly effected, a slow current of sulphuretted hydrogen is passed through the filtrate, and the liquid is filtered from the sulphuret of mercury formed.

"The separation of the mercury may also be omitted, if care be taken to guard against the vapours of mercury which escape on heating it with sulphuric acid. The filtrate is evaporated with the addition of sulphuric acid until the urea is completely decomposed. The fluid thus obtained is treated as above described. Another weighed portion of the urine is also precipitated with bichloride of mercury, the precipitate washed with alcohol, and the filtrate treated with bichloride of platinum and ether. The platinum obtained enables us to calculate the amount of potash and ammonia present.

"The author found that albumen is not perfectly precipitated by boiling even from acid urine, neither, indeed, is it admissible to use nitric acid when the urine is subsequently to be treated for the estimation of urea, since, by the action of sulphuric acid, nitrous acid would be formed, which decomposes the urea so as to liberate part of the nitrogen in the gaseous state. He also found that with alcohol a considerable amount of albumen may, in many cases, remain unprecipitated; and that, moreover, the albumen precipitated by alcohol is very difficult to wash. The above process has been shown by Heintz to be applicable to the estimation of the urea in urine containing blood, milk, and bile. In the latter case, should the urea amount to one ninth of that of the urine (which could hardly occur), the error would not exceed 0.16 per 1000.

"*Bunsen's Method of Estimating Urea.*—It is founded on the fact that aqueous solutions of urea are readily decomposed into carbonate of ammonia when heated above 212° in hermetically-closed vessels. The metamorphosis begins even below 248°, but proceeds so slowly at this temperature that it is not completed in three or four hours; while, if the temperature is kept between 428° and 464°, three or four hours suffice for perfect decomposition. To apply this reaction to the determination of the amount of urea in liquids, it suffices to heat them, in strong glass tubes, with an ammoniacal solution of chloride of barium up to 428°—464°. A precipitate of carbonate of baryta equivalent to the amount of urea is obtained.

"The author found that none of the different nitrogenous substances present in the urine interfered with the accuracy of this method, and he proved, by direct experiment, that it possesses sufficient accuracy even in the presence of substances the most widely diffused in the animal body. In order to avoid the influence which the so-called extractive substances of the urine may

exert, Bunsen determines the urea from two separate portions of the urine, one of which has been previously deprived of its extractive substances by basic acetate of lead, and he gives a formula for facilitating the calculation from the results of the analysis.

"*Estimation of the Uric Acid.*—A weighed quantity of the fresh urine is precipitated by strong acetic acid; the precipitate is collected on a weighed filter, and washed with water acidified with acetic acid. According to Liebig, the uric acid in the urine is held in solution by phosphate of soda; it has been proved, however, by Heintz, that this in nowise interferes with the accuracy of the method. The uric acid, during its precipitation, carries with it a certain quantity of the colouring substances of the urine; but, according to Heintz, the increase of weight from this cause is about compensated for by the loss which the uric acid sustains by washing. Lastly, the same chemist has proved, by direct experiment, that neither sugar, albumen, nor blood, have any essential influence upon the quantitative estimation of uric acid, provided acetic acid be employed as the precipitant.

"*Estimation of the Hippuric Acid.*—A weighed or measured quantity of fresh urine is evaporated over the water-bath to the consistence of a thin syrup, and, on cooling, one twentieth part of strong hydrochloric acid added to it, then shaken with ether: this dissolves the hippuric acid which has separated. It frequently happens that the ethers, as in an emulsion, separate with difficulty from the resin; but this is instantly effected by the addition of a few drops of alcohol. In this case the ethereal solution of the hippuric acid should be shaken previous to evaporation with some water, in order to remove the urea taken up by the ethereal solution through the intermediation of the alcohol. When this is done crystals of pure hippuric acid are obtained on evaporation of the ethereal solution. In stale urine the hippuric acid gives place to benzoic acid, and, when concentrated and distilled, a large quantity of acetic acid is also obtained. Another method of separating the hippuric acid from normal urine is to evaporate until the salts are deposited, and then to add strong alcohol and apply heat; uric acid remains undissolved. The clear solution is evaporated nearly to dryness, the residue redissolved in hot water, and the urea decomposed by passing a current of chlorine through the solution; a small quantity of a mineral acid is then added, and the solution concentrated, when the hippuric acid is obtained in a crystalline state.

"*Detection of Bile in Urine.*—A spirituous extract of the secretion is evaporated nearly to dryness on the water-bath; the residue, when cold, is transferred to a test-tube. When quite cold sulphuric acid and a very small quantity of a solution of one part of cane-sugar to four or five of water is added, the temperature of the solution being kept as low as possible. In the course of a few minutes, if the most minute trace of bile be present, a violet-red colour of more or less distinctness is produced. Concentrated hydrochloric acid, heated with bile and sugar, likewise produces a red colour, but it is much lighter and less beautiful than that with sulphuric acid. The following precautions, in the application of this test, are prescribed by its author (M. Pettenkofer).

"1st. The temperature must not exceed 144° Fahr., otherwise the colour may be destroyed; 2d, the quantity of sugar must not be too large, or sulphurous acid may be formed, whereby the colour may be concealed; 3d, the sulphuric acid must be free from sulphurous acid; 4th, if the fluid should contain albumen it should be previously coagulated; 5th, great excess of chlorides converts the colour to a brownish-red; they should, therefore, be separated. To detect the constituents of the bile in urine M. Schwertfeger recommends precipitating with basic acetate of lead. When bile is present a yellow precipitate is formed, from which a green solution is obtained with alcohol containing some sulphuric acid, and from which pure alcohol extracts, with the assistance of heat, bilate of lead. It is impossible to conclude from the colour of the urine as to the presence of bile, since similar colours may likewise originate from other causes.

"*Detection and Separation of Kreatine.*—Pettenkofer and Heintz give the following as the most advantageous method. To the alcoholic extract of the urine an alcoholic solution of chloride of zinc is added; in a short time a deposit is formed, which contains the kreatine in combination with chloride of zinc, together with a small quantity of phosphate of zinc. These two substances are separated by boiling water, which dissolves the first, but which is without action upon the latter. The pure kreatine is obtained from the aqueous solution of its combination with chloride of zinc, by precipitating the zinc with hydrosulphuret of ammonia; after having evaporated the filtered liquor as far as possible without a precipitate being formed from the boiling solution, absolute alcohol is added to it, when the kreatine is immediately deposited in the form of small crystals resembling those obtained in operating upon the alcoholic solution of the aqueous extract of meat. The composition of these crystals, according to Heintz, leads to the formula, $C_8H_9N_3O_4+2HO$, which is the same as that advanced by Liebig.

"*Detection of Oxalate of Lime.*—The following process is recommended by Dr. Golding Bird. Allow a portion of the urine passed a few hours after a meal to repose in a glass vessel; if this be done in winter, or during the prevalence of frequent and rapid alterations of temperature, a more or less dense deposit of urate of ammonia will generally make its appearance, arising either from the sudden cooling of the urine, or interference with the functions of the skin prior to excretion. In warm weather, however, or when the functions of the skin are tolerably perfect, the urine, albeit it may be loaded with oxalate of lime, may still appear limpid, or, at furthest, its lower layers only be rendered opaque by the deposition of a cloud of vesical mucus. Decant the upper six sevenths of the urine; pour a portion of the remainder into a watch-glass, and gently warm it over a lamp; in a few seconds the heat will have rendered the fluid specifically lighter, and induced the deposition of crystals of oxalate, if any were present; this may be hastened by gently moving the glass to and fro, so as to give the fluid a rotatory motion, which will collect the oxalate to the bottom of the capsule. The application of warmth serves also to remove the obscurity arising from the presence of urate of ammonia, which, as is well known, is readily dissolved by exposing the urine containing it to a gentle heat.

"Having allowed the urine to repose for a minute or two, remove the greater portion of the fluid with a pipette, and replace it by distilled water. A white powder, often of a glittering appearance, will now become visible, and this, under a low magnifying power, as by placing the capsule under a microscope furnished with a half-inch object-glass, will be found to consist of splendid crystals of oxalate of lime in beautifully-formed octohedra, with sharply-defined edges and angles. It sometimes occurs that the oxalate is present in the form of exceedingly minute crystals; it then resembles a series of minute cubes, often adhering together like blood-discs; these, however, are readily and rapidly resolved into octohedra under a high magnifying power.

"*Determination of the Alkaline and Earthy Phosphates.*—Dr. Bence Jones, in his investigations relative to the amount of phosphates in the urine of a healthy man, adopted the following method:—The specific gravity of the urine was first taken, and if ever it was not strongly acid a drop or two of hydrochloric acid was added. Then, from a weighed quantity, usually about 1,000 grains, the earthy phosphates were precipitated by means of pure ammonia, filtered, washed with ammoniacal water, and then heated to redness; a drop or two of nitric acid being added at the last. The alkaline phosphates were estimated by taking usually 500 grains of the urine, adding an excess of chloride of calcium and then pure ammonia; by this means all the phosphoric acid was precipitated as phosphate of lime; this was filtered, well washed, and heated to redness with nitric acid. By deducting the previously-determined earthy phosphates, the difference was considered as alkaline phosphates. The results, though they answered well for the purposes of comparison, are somewhat too high, in consequence of the formation of a small quantity of carbonate of ammonia and the precipitation of some sulphate of lime, which even long washing cannot entirely remove.

"*Detection of Sugar in Urine.*

"1. *Hünefeld's Test.*—Place four ounces of the suspected urine in a glass exposed to the sun's rays, and add about six drops of a tolerably strong solution of chromic acid. In a few minutes the mixture, previously orange-red, becomes brownish, and soon after assumes a bistre-brown colour, if sugar be present. These changes take place much more quickly if the mixture of urine and chromic acid be gently warmed before exposure to light. This test depends for its action upon the deoxidizing power of the sugar, by which the chromic acid is reduced to oxide of chromium; for, after warming the mixture, the addition of a few drops of liquor potassæ produces a copious deposit of green oxide. There is an important objection to this test, which renders all its indications liable to serious fallacy, depending upon the fact that all urine containing a normal proportion of colouring matter deoxidizes chromic acid; and, consequently, urine, whether saccharine or not, will partially convert this acid into oxide. This change certainly does not occur so readily in non-saccharine urine as in a diabetic state of that fluid, but still it is sufficiently marked to prevent Hünefeld's test being regarded in any other light than a fallacious one.

"2. *Runge's Test.*—Allow a thin layer of the suspected urine to evaporate on a white surface, as the bottom of a white plate; and, whilst warm, drop upon the surface a few drops of sulphuric acid, previously diluted with six parts of water. With healthy urine the part touched with the acid becomes merely of a pale yellow colour, from the action of the latter on the colouring matter of the urine; whilst if sugar be present the spot becomes deep brown, and soon black from the decomposition of sugar by the acid, and consequent evolution of carbon. This test is stated to be so delicate that 1 part of sugar dissolved in 1000 of urine can be readily detected; and even when mixed with 2000 parts the indications are tolerably distinct. According to Dr. Golding Bird, the presence of albumen introduces a fallacy into the application of this test, the acid assuming a tint nearly resembling that produced by sugar.

"3. *Trommer's Test.*—This is a very trustworthy test, and much superior to either of the preceding. Add to the suspected urine contained in a large test-tube a few drops of a solution of sulphate of copper. A very inconsiderable troubling generally results, probably from the deposition of a little phosphate of copper. Sufficient liquor potassæ should then be added to render the whole strongly alkaline; a greyish-green precipitate of hydrated oxide of copper falls, which, if sugar be present, wholly or partly redissolves in an excess of the solution of potassa, forming a blue liquid not very unlike the blue ammoniuret of copper. On gently heating the mixture nearly to ebullition, the copper falls in the state of suboxide, forming a red and copious precipitate. If sugar be not present, the copper is deposited in the form of black oxide. This test is founded on a fact long known, but not previously applied to the detection of sugar, of the power possessed by some organic matter of reducing oxide of copper, as well as some other oxides, to a lower state of oxidation. It is important that no more of the solution of sulphate of copper be used than is sufficient to afford a decided precipitate on the addition of the liquor potassæ. If this precaution be not attended to, a part only of the black oxide will be reduced to red oxide, unless a very large quan-

tity of sugar be present, and thus the indications of the test will be rendered indistinct.

"4. *Test of Fermentation.*—The development of the vinous fermentation, on the addition of a little ferment or yeast to a fluid, has long been applied to the detection of sugar. When a little yeast is added to healthy urine, and exposed to a temperature of about 80°, no other change occurs for some time, exeept the development of a portion of earbonie acid mechanieally entangled in the yeast. When sugar is present in the urine thus treated, it soon becomes troubled, a tolerably free disengagement of bubbles of carbonic acid takes place, and a frothy scum forms on the surface of the fluid, which evolves a vinous odour. These ehanges take place with great rapidity, even when the quantity of sugar present is very small. If the evolved carbonie aeid be collected, the quantity of sugar in the urine may be determined by measuring it, as a cubie ineh of the gas very nearly corresponds to a grain of sugar.

"In the great majority of specimens of diabetic urine it is not necessary to add yeast to excite fermentation, provided a suffieient temperature be employed.

"5. *Test afforded by the Growth of Torulæ.*—If the smallest proportion of sugar exists in urine, exposed for a few hours to a temperature above 70°, and a drop of the fluid (taken from the surfaee) be examined under the mieroseope, numerous very minute ovoid partieles will be discovered. In the eourse of a few hours more these become enlarged and appear as distinet oval or egg-shaped vesielcs, whieh soon become developed into a eonfervoid or fungoid vegetation, identieal with that which appears in ordinary saccharine fluids when undergoing the vinous fermentation. The advantages of this test are the facility with whieh its indications are observed by the microseope with an objeet-glass of one seventh or one eighth inch foeus, and the certainty of any possible fallaey being correeted by the subsequent development of fermentation. It is, however, less convenient than Trommer's, in consequence of the time required before its indications ean be observed.

"6. *Löwig's Method.*—Evaporate the urine to the consistenee of a syrup, then exhaust the residue with aleohol. The alcoholic urinary solution is then mixed with an aleoholie solution of potash, when, if sugar be present, a white precipitate, a eompound of sugar and potash, is formed, which, when washed with aleohol and then dissolved in water, yields a saccharine solution, whieh is fit for any further examination, and from which the amount of sugar may be ascertained quantitatively, if necessary.

"URINARY CALCULI.

"*Uric Acid.*—These, which are the most abundant, are known by their solubility in eaustie potassa, and their preeipitation from the alkaline solution by acids. In nitric acid, with the aid of heat, they are soluble, and the solution, when evaporated to dryness, leaves a residue whieh, on the addition of ammonia, assumes a purple-red colour (murexide). Before the blowpipe the uric aeid calculus is consumed, leaving a small quantity of a white ash, whieh has an alkaline reaction.

"*Urate of Ammonia.*—This calculus is distinguished from the last by its solubility in carbonate of potassa, and by its evolving ammonia when digested with eaustie potassa.

"*Bone Earth.*—This also is a eommon calculus. It is insoluble in caustic alkalis, and does not burn when heated. In a strong heat it fuscs. It is insoluble in aeetic aeid, but is soluble in the mineral acids even when diluted.

"*Ammonio-Magnesian Phosphate.*—This calculus is soluble in acetie aeid, and again preeipitated by ammonia. It evolves ammonia when digested with eaustie potassa, and also when heated alone. It has frequently a crystalline appearance.

"*Fusible Calculus.*—This is a mixture of the two preceding. It is partly soluble in aeetie, and wholly in hydroehloric, acid. It melts easily before the blowpipe into a pearly bead.

"*Oxalate of Lime.*—Insoluble in acetic acid: converted by heat into carbonate of lime, whieh dissolves in aeids with effervescence. It is also decomposed by boiling with carbonate of potassa. It is very hard, and has a dark-coloured rough surface.

"*Xanthic Oxide.*—This calculus is rare. It is soluble in potash, but is reprecipitated by earbonie acid. It dissolves in nitrie aeid without efferveseenee. It is distinguished from uric acid in not furnishing murexide when ammonia is added to the residue on evaporating the nitric solution.

"The above are the most frequently-oeeurring calculi. It is not uncommon, however, to meet with ealeuli in which layers of urie acid alternate with layers of phosphate of lime, ammoniomagnesian phosphate, and fusible ealculus."

In taking leave of Mr. Noad's treatise we confidently recommend it to our readers, and desire it every suceess.

THE CHEMICAL TIMES.

SATURDAY, JANUARY 6, 1849.

OUR OWN SERIES.

No. V.

ON CHEMICAL MANIPULATION.

Glass Bending, Sealing, and Blowing—(*Continued*).

When the proper apparatus has been adjusted so as to be in every respect well in order, according to the directions already given, the learner should eommence by trying to bend a piece of glass tubc.

For this purpose a piece of tubing of moderate thiekness, and of English flint glass, should be chosen, as being by far more easily worked than any other kind.

Every one knows that the sudden application of heat to glass vessels is very liable to produce fracture, and when heated so is the sudden application of cold;—in other words, sudden alterations of temperature are liable to destroy the cohesion of glass. In all blowpipe operations on this material the foregoing rule must be well remembered and acted upon. It is a source of wonder to persons unaccustomed to chemical experiments to see the facility with which chemical operators apply heat to glass without producing fracture; the general idea being that glass vessels must necessarily—as the expression goes—*fly*. All depends on the graduated applieation of heat. Before bringing a tube, or other glass piece, into the body of the blowpipe flame—to be bent, or blown, or sealed—it should be held for a short time in the heated atmosphere, which extends far beyond the apex of the flame, and in the direction of its axis.

By turning the tube round and round, and sliding it gradually from side to side, so much of its superficies should be warmed as it is hereafter desired to heat to a higher degree, and gradually should be brought into the pale red or outer cone of flame, when the necessary amount of heat will be applied to admit of further operations.

As a general rule, it cannot be too often impressed upon the operator that glass pieces, whilst exposed to the blowpipe flame, should be continually made to revolve on their axes, never held still, which latter fault is one of the most frequent of those committed by young operators on glass.

The consequence of not attending to the rule laid down is, that the glass no sooner softens than it droops, and thus assumes all manner of irregular forms. We will conceive the tube to have been gradually heated, and to have been held in the hazy outside cone of flame for a sufficient time to produce a softening. This condition will be easily recognised by the peculiar colour which the glass at this period assumes, and by the sensation of yielding imparted to the operator's hands. The bending proeess may now commence; it is one of great theoretical simplicity, but whieh in practice requires considerable tact to result in suceess. If the operator attempt to bend a tube by one sweep he will certainly produce an angular turn in which the cylindrical contour of it is entirely lost, and he may even occlude the orifice, so as to admit the passage only of a thin sheet of air or liquid. Such a bend is totally unfitted for any chemical purpose whatsoever. These bad results may be avoided by softening successive portions of tube, and bending each a little in succession, making the one bend an aggregate of many little ones, the line of demarcation between which not being evident. Occasionally, if an angular bend have been made with flat bore, the improper condition may be obviated by occluding, by a cork or otherwise, one orifice of the tube, then melting the outside wall of the angular portion of the tube, and forcing by the breath the melted portion of the glass into an incipient bubble.

We have omitted to make a remark that some operators on glass might consider to apply to all cases of tube-bending; but which, in our opinion, only relates to tubes of thickness under a certain degree, which practice alone can determine. The remark applies to a preparatory operation of thickening invariably necessary as a preliminary to bending, whenever thin tubes have to be operated upon. This process of thickening consists in pressing together the two ends of a tube in the direction of its axis during the application of heat.

This operation is one of considerable delicacy,—involving the necessity of a continual rotation and a sensitive touch,—otherwise the tube, instead of being simply thickened, will be distorted into some irregular form. The use of this preliminary thickening operation will be evident when it is considered that in every bend the outer wall exposes a far larger surface than the inner one; hence, if made from an insufficient supply of melted glass, this outer wall becomes so thin that it readily fractures.

The bend having been accomplished to the operator's desire, the heated glass should be removed from the flame no less gradually than it was exposed to the same, especially if the tube be thick.

The next operation we shall treat of is that of the closing or sealing, as it is called, of tubes,—an operation, perhaps, as of equal frequency with the last described.

Two cases may occur involving this operation. One in which a tube open at both ends is melted in the middle and divided, so that two sealed tubes are the result; the other in which

the tube has to be closed as near as possible to its extremity.

The former being the simpler case, we will describe it first. The operator, with all due precautions as regards the gradual application of heat, applies his blowpipe jet to the middle of the tube, continually turning it as before; he now pulls each end, rotating all the time, the result of which combined operation is, that the tube contracts in size at the point where the heat is applied, and may be elongated to a tube of even microscopic dimensions. In the case under consideration, however, the extension should not be carried further than about one inch or an inch and a half. The operation having proceeded thus far, the operator should determine which portion of the tube he intends to finish, it being impossible to finish both at one operation; accordingly one portion of the tube will be accurately closed, the other being merely employed as a handle to facilitate him in his work. The operator now applies a somewhat small jet flame to the portion of the tube whence the small bored extension springs, and twists the latter round, pulling it at the same time away. By this means he at length cuts off all connection between it and the fashioned end. The latter, at this period of the operation, will generally be deformed by the presence of a little button of glass which it is very difficult entirely to remove: it may be, however, accomplished by delicately touching it when fused with a little rod of glass, and extending it into a fine thread, which, when cut off, should leave a smaller button than the one which preceded. A button, however, there will be even now, and which can only be got rid of by fusing it into the surrounding mass of glass;—a process which generally will have rendered the closed end so thick that it will not be adapted for chemical use until it have been softened and slightly expanded by the breath.

The closing of a tube at the end only differs from the preceding operations in this, that it is necessary as a preliminary to fuse on a handle of glass tube or rod, which being done, the tube to be operated on should be brought to incipient fusion as near as possible to its extremity, and treated as already described.

THE NEW EDUCATIONAL MOVEMENT.

A VERY old argument of the supporters of the old educational system was, that an education either purely classical or purely mathematical, although not immediately adapted to minister to every educational want, nevertheless afforded such a foundation to other acquirements, that all further information which might be necessary to suit the *specialities* of any one profession or calling in life might, nay, must, be easily obtained. This acquisition, indeed, was thought to be a matter of so little difficulty that it has been the fashion to consider it in a manner absorbed, or propagated, by contagion, diffused by some process not less mysterious than the spread of cholera or the plague.

So far as the more beaten tracks of human exertion extend—so far as the various well-defined professions, trades, or occupations, open their prospect to our view—it would be difficult to prove the fallacy of the old educational law. In all these cases a second educational course, specially adapted to the newer circumstances, being superadded, the requisite kind of information is obtained.

Immediately, however, we pass beyond the limits of the more defined professions or occupations, and into the region of those which may be termed—having regard to the information required—undefined or erratic, it is then the inadequacy of our school and university system becomes manifest.

Thus it would be the exception rather than the law to find a physician ignorant of chemistry, or a barrister of the principles of the Justinian Code, inasmuch as the professional education of each individual has instilled the necessary information, the study of law and physic being amongst the occupations which we have termed defined. Set the physician, however, to write a thesis on the principles of the Justinian Code, or the lawyer to expatiate on the atomic theory or the doctrine of substitution, and each will probably illustrate pretty fully the *ne sutor* dictum of the Roman bard.

How far it might have been profitable for the lawyer and the physician, each, to have learned the outlines of the other's pursuit, we need not say. The question is one of degree,—one which we are neither learned nor arrogant enough to settle. It involves, in point of fact, an extreme case,—one that, regarded alone and without its commentary, is not devoid of something ridiculous. Viewed, however, as an exponent of the proposition, that our old school and university system has been too exclusive, too limited to accomplish the end of imparting the generally best kind of information, its ridicule will cease. Passing on to the undefined or erratic professions or occupations, we will take as the leading example of such the occupation of journalism, one which is at once so comprehensive in its generalities, and so various in its details, that it would be difficult to mention the kind of information which in some cases could not be made available.

The higher organs of London journalism are unquestionably catered for by men of the most profound views and highest attainments—men who, for the most part, have superadded to a specific professional training a good acquaintance with the policy of their own and foreign states—men of ready *nous*, who can write editorially in language that shall rank amongst the most eloquent of essays on many, if not on most, of the varying topics which may be the engrossing subjects of the day. The leading articles of the *Times* newspaper, we are free to own, when viewed in the aggregate, are masterpieces of literary structure; and in general their statements are correct. In one respect, however, they fail most lamentably; and this failure we will cite to demonstrate the proposition with which we set out, that the educational foundation laid at our schools and universities hitherto has been too exclusive as to its selection, too limited as to its ends. Let there appear in the *Times* an editorial article bearing upon any scientific subject, and the account shall not generally, but *invariably*, be incorrect—shall be garbled, in a cloud, and therefore obscure, or, if palpable, only palpably wrong.

We pass over all such matters as reports of trials involving scientific points; for inaccuracies here, in a journal of general information, there is many a valid excuse: with regard to editorial productions, however, there is none, for it is not compulsory for any one to write on matters which he does not understand.

Most of our readers, who also read the *Times*, will have noticed in an editorial article appearing in that journal some days since, relative to intramural interments, a glaring chemical error. Sir Benjamin Brodie is cited as an authority to prove that atmospheric air containing 1-500th part of hydrosulphuric acid is immediately fatal when breathed. Whether Sir B. Brodie has said this we cannot tell, neither does it concern the question: no editor should have trusted himself to expatiate on such a matter who had not a sufficient knowledge of chemical science to enable him to check so glaring an absurdity.

Were the statement really true, why, there would be an end to laboratory experiments and of analytical chemistry; for it must have occurred to many of our readers to inspire sulphuretted hydrogen in much larger quantities than those laid down as immediately fatal by Sir Benjamin Brodie and the *Times*.

A few days subsequently the *Times* favoured the public with another chemical leader, being an exposition of the qualities of water. "The quality of all the water at present supplied to London by the water companies is," remarks the *Times*, "as regards hardness, decidedly bad. Whether hard or soft water be the better for the health of those who drink it, and what is the degree of hardness the best for, or the least injurious to, the human body, are questions yet, we believe, unanswered." If this be like anything, it is like the twaddle of a washerwoman. Jupiter, having taken in hand the distaff, should have spun a better yarn.

The term hardness, as most of our readers are aware, is, as applied to water, synonymous with the expression, prevalence of salts; therefore the more of salts in solution the harder the water;—and the question whether or not the quality of hardness be or be not conducive to health will depend on the kind no less than on the amount of salts present. On one point, however, the *Times* thinks all argument needless, so palpable the inferences are presumed to be. The point, we confess, is somewhat novel to us. A great deal of argument would be necessary to obliterate certain preconceived impressions on our minds:—"That hard water is decidedly bad for most domestic and many manufacturing purposes is a fact not admitting of a doubt. The hundreds of thousands of pounds which have been literally 'sunk' in boring to the sand or the chalk under London for a supply of soft water to breweries, sugar-works, and other large establishments, render an argument on this point needless." Needless indeed! Why, in our lecture-going days, did not our professors of chemistry inculcate the fact, as proved by most unerring tests, that London pump water, as compared with the New River water, was much, very much, more loaded with mineral compounds, and, therefore, much more hard? Hundreds of thousands of pounds literally sunk for the purpose of getting *soft* water out of the London

basin! Was there ever such egregious nonsense? "Another point," remarks the *Times*, "of probably equal importance would be, whatever should be the source of the supply, to show that the water would not act on lead. The water at present supplied to London is understood to pass through leaden pipes and to remain in leaden cisterns without acquiring any poisonous taint. The recent experience at Claremont is quite enough to convince the most sceptical that the introduction into London of any water, the qualities of which had not been previously found to be such as to permit its harmless contact with lead, might be far worse than going on with the present scanty supply." How great an amount of ignorance is here condensed—how glaringly manifest to the chemically informed! The *Times*, without knowing it, plays fast and loose,—blows hot and cold,—and prates with the most garrulous simplicity of the supply of soft water through leaden pipes, perfectly innocent of the well-known chemical fact that the presence of these mineral salts, on which the quality of hardness depends, is the only circumstance which prevents the solution of lead in water; hence that it will be ever impossible to convey pure water through leaden pipes without the imparting a poisonous taint. And yet crude puerilities like these are to furnish hints to our legislators! Nothing, we say, could better demonstrate the necessity of extending the basis of a popular education—nothing could better demonstrate the impropriety of omitting the principles of chemical and physical science from the ordinary routine of instruction imparted to British youth. In a country like Britain, at this time, a respectable knowledge of political economy and international affairs may be acquired by chance, instinctively almost, and without care; thus the defects of an early education in this respect may be held concealed: but there are other channels of knowledge—not less necessary to be explored—whose sources are more hidden, whose current is more noiseless and obscured,—channels to which the mind requires to be directed, and generally during youth, or else they cross our path unheeded and unseen. Of these, we say, the study of chemistry and of physics are notable examples.

COURSE OF BLOWPIPE OPERATIONS

[*Continued from page* 108.]

A. GASEOUS SUBSTANCES, WHICH MAY BE RECOGNISED BY THEIR PECULIAR ODOUR DURING ROASTING.

Sulphurous acid belongs to this order, and it is formed when the substance contains metallic sulphurets. The least quantity of this acid may be identified by its odour, when after having brought to a red heat the substance contained in the tube, held horizontally, the extremity of the tube is immediately brought under the nose whilst holding it as perpendicularly as possible. A strip of moistened brazil-wood paper introduced in the interior of the raised end of the tube is decolorized by the sulphurous acid. Almost all metallic sulphurets being thus treated disengage sulphurous acid. Some of them yield a sublimate of sulphur besides. This is the case especially with those which, when heated in the small glass flask, have already lost a portion of sulphur; yet this phenomenon depends also on the greater or less degree of inclination given to the tube whilst the roasting is taking place. Some metallic sulphurets yield other sublimates besides, of which we shall speak further on. The native sulphurets of zinc and of molybdenum are those which yield sulphurous acid with most difficulty whilst roasting. When compounds of metallic sulphurets and arseniurets have been treated in a small glass flask, and have thus yielded a sublimate of arsenic, they may still exhale an odour of sulphurous acid when heated in a glass tube open at both ends; this is particularly the case with the arsenical pyrites.

The presence of selenium and of metallic seleniurets may, likewise, be recognised by the odour which is disengaged during the roasting; but no sublimate of selenium is obtained, especially when the tube is not held too horizontally.

A few metallic arseniurets exhale an odour of arsenic when roasted in the tube. This phenomenon, however, is produced only by those which, besides a sublimate of arsenious acid, yield one of arsenic also when the tube is not held too horizontally. If, whilst roasting the metallic arseniurets in the tube, nothing but arsenious acid is formed, no odour of arsenic is exhaled.

B. SUBSTANCES WHICH, BEING ROASTED IN A GLASS TUBE OPEN AT BOTH ENDS, YIELD A SUBLIMATE.

If the sublimate be white, it consists generally of oxides, which sometimes exist ready formed in the substance under examination, and sometimes are formed by the oxidization of the metal during the roasting. The following belong to this class:—

Arsenious Acid.—This acid is formed during the roasting of metallic arseniurets, and condenses on the cold sides of the tube in the form of a white sublimate, which has a crystalline appearance when viewed through a magnifying-glass. The smallest particle of this sublimed acid may then be treated, as formerly indicated, for the purpose of determining whether it contains arsenic. Certain metallic arseniurets, being roasted, yield arsenious acid more easily than other metallic arseniurets, and its production often requires that the substance be held for a long time at a red heat, by directing upon it the flame of the blowpipe; such, for example, is the case with grey cobalt. Certain metallic arseniurets, being roasted in a tube open at both ends, yield both arsenious acid and metallic arsenic. Submitted to the same treatment, the sulphurets of arsenic, or the substances which contain them, generally yield both arsenious acid and a sublimate of red sulphuret of arsenic, or even of yellow sulphuret of arsenic; the latter, as we have already observed, may be mistaken for sulphur. Arsenious acid may likewise be disengaged, by roasting in a tube open at both ends, from substances which contain a great excess of arsenious or of arsenic acids, or which are principally composed of both these acids.

Oxide of Antimony.—This oxide is sublimed when antimony or metallic antimoniurets, sulphuret of antimony, or combinations containing sulphuret of antimony are roasted, and likewise when oxide of antimony or compounds containing it are heated in a tube open at both ends. The sublimate thus produced is white; a gentle heat is sufficient to shift it from one place to another, which circumstance chiefly characterises it. In most cases, however, the fumes produced in the tube by roasting substances which contain antimony are not due to oxide of antimony alone, but to some antimonious acid, which is not volatile, it is true, but which, when the roasting takes place in contact with the air, is formed at the expense of the oxide of antimony during its volatilization, and condenses also in the cold sides of the tube under the form of a sublimate, above the point occupied by the substance under examination. Such a sublimate, consisting of oxide of antimony and of antimonious acid, cannot, therefore, be wholly volatilized by heat. This sublimate is especially produced by the roasting of sulphuret of antimony, or of substances containing sulphuret of antimony, and of some metallic antimoniurets, principally when the metals combined with the antimony are easily oxidizable. When the substances which contain sulphuret of antimony contain lead also (as for example, in the mineral called bournonite), the roasting in the glass tube yields a white precipitate, which is partly volatile and partly non-volatile, and which consists of oxide of antimony and of antimoniate of lead.

Tellurious Acid.—The sublimate of tellurious acid is formed whilst roasting tellurious acid and metallic tellurets, also when tellurious acid and some of its combinations are heated in an open glass tube. The volatilized tellurious acid forms a white smoke, but is much less volatile than oxide of antimony, from which it can, therefore, be easily distinguished, because it cannot be shifted from one place to another by heating it, and because the application of heat fuses it into colourless drops. When metallic tellurets contain lead, a sublimate of tellurious acid is formed, it is true, at a certain distance from the substance under examination, but another sublimate takes place nearer that substance, which is a combination of tellurious acid and oxide of lead, which cannot be fused into drops, and which, therefore, might be mistaken for antimonious acid.

Chloride of Lead volatilizes nearly in the same manner as tellurious acid, and fuses likewise into drops when heated.

Oxide of Bismuth is formed during the oxidization (in the tube) of sulphuret of bismuth, and of the alloys of bismuth with other metals, but scarcely any sublimate is produced by roasting bismuth itself. The sublimate, being heated, fuses into drops, but which are brownish or yellowish, a character which distinguishes it from the sublimate of tellurious acid. A substance which contains bismuth, upon being heated red hot in the tube, becomes surrounded by a sublimate of fused oxide of bismuth, which is of a dark yellow colour whilst hot, but which becomes of a lighter hue in cooling. This phenomenon easily distinguishes bismuth from several other metals; but it is more difficult to distinguish it in this manner from lead, the combinations of which, when treated in that way, become likewise surrounded with a fused yellow oxide, the colour of which, however, is, after cooling, lighter than that of fused oxide of bismuth. But we shall describe further on how these two metals may easily be distinguished from each other in their combinations.

Other metals, besides arsenic, tellurium, antimony, and bismuth, yield a white sublimate when their combinations are heated in the open tube. Among these metallic compounds we may name sulphuret of lead and seleniuret of lead, which yield white sublimates of sulphate and of selenite of lead. The sublimates become grey when heated, and may thus be fused. (I have had already several times occasion to remark, that the combinations of lead with the metals and other substances, being heated in the tube, yield sublimates, when the effect of the oxidization of these metals is to produce volatile metallic oxides or acids.) Persulphuret of tin yields a thick smoke of peroxide of tin, which cannot be volatilized by heat; molybdic acid, heated in the open tube, is volatilized partly under the form of a white pulverulent sublimate, and partly under the form of brilliant crystals, with a slight yellowish tinge, whilst sulphuret of molybdenum, being treated in the same manner, yields sulphurous acid only, and no sublimate.

All the sublimates which are formed by oxidizing substances in the open tube are white, but the coloured substances which can be already volatilized out of the contact of the air in the small glass flask are still more easily volatilized in the open tube. Most of the combinations of mercury yield a sublimate of metallic mercury when heated in the open tube; if sulphuret of mercury be thus treated, part of it volatilizes without decomposition, and another portion yields likewise metallic mercury, which, being more volatile than the sulphuret, condenses on the cold sides of the tube at a greater distance from the heated point. The chlorides of mercury

are volatilized in the open tube without decomposition.

I have indicated how the metallic fluorides can be recognised by heating them in an open tube, with or without microcosmic salt.

THIRD OPERATION.

After having tried the substance in the small glass flask, and in the open tube, another portion is to be taken and heated by itself in the flame of the blowpipe. The object of this operation is not only to ascertain whether the substance is fusible, but also to observe the change of colour which it undergoes, or which it communicates to the flame, and also the changes which it exhibits both in the oxidizing and in the reducing flame. For this purpose the substance is heated according to the object in view, either on a charcoal support or between the platinum points of a forceps, or upon platinum wire.

In order to ascertain the degree of fusibility of substances before the blowpipe, they are to be placed upon a charcoal support when they consist of metals, or of easily reducible metallic oxides, or in general when they contain bodies susceptible of attacking platinum; and then they are exposed to the hottest part of the flame (that is to say, to the reducing flame). If, however, the substance is composed of constituent principles which cannot attack platinum in the hot way, a small fragment or splinter of the substance is to be taken and exposed to the hottest part of the flame by holding it between the points of a platinum forceps. This latter process is especially applicable to substances which contain silicic acid, or other minerals which contain about the same principles, but in very different relative proportions, and which may very often be distinguished from each other by their different degrees of fusibility before the blowpipe. If the substance under examination is in the form of small grains, one of them is to be placed upon the charcoal support, and the flame of the blowpipe is directed upon it. If the substance be in powder, it may be kneaded with saliva, and a small portion is placed upon the charcoal support; but in that case, if the substance be infusible, or difficultly fusible, the operator can hardly prevent its being carried away by the blast.

Most metals fuse before the flame of the blowpipe, and all of them, except those called noble, are subsequently oxidized by the exterior flame. Among the noble metals, gold and silver fuse before the blowpipe without undergoing the slightest change; platinum, iridium, palladium, rhodium, osmium, are infusible; yet osmium is converted, by the exterior flame, into osmic acid which volatilizes. Among the other metals the oxides of which are reducible by the interior flame, especially with the help of soda, molybdenum, tungsten, nickel, cobalt, and iron, are infusible. Among the number of the metals which have not been named, there are several which are infusible also; but those cannot be obtained in the metallic state by means of the blowpipe.

Most metallic sulphurets fuse when treated before the blowpipe upon charcoal, and this effect often takes place with sulphurets of metals the oxides of which are infusible; but many of these sulphurets become rapidly oxidized during the operation, and exhale an odour of sulphurous acid in the same way as when treated in the open tube, and are thus converted into metallic oxides.

Most of the pure metallic oxides are infusible; yet several of them, when treated in the exterior flame, pass to a higher degree of oxidization; and when treated in the interior flame are reduced to a lower degree of oxidization, or even to the metallic state. The infusible oxides are—baryta and strontia, the hydrates and carbonates of which are fusible, but are converted into the pure earths when heated upon charcoal, and then form infusible masses; lime, which becomes very luminous when thus treated; magnesia, alumina, glucina, yttria, zirconia, which become very luminous also by the action of the heat; silicic acid, tungstic acid, oxide of chromium, antimonious acid, which, however, is reduced by the interior flame into volatile oxide of antimony; tantalic acid, titanic acid, protoxide of uranium, peroxide of uranium, which is reduced by the flame of the blowpipe to the state of protoxide of uranium; protoxide of cerium, which is converted by the blowpipe into peroxide of cerium; peroxide of cerium, sesquioxide of manganese, which parts with a portion of its oxygen when strongly heated; oxide of zinc, which is reduced by the interior flame, and thus becomes volatile; oxide of cadmium, which is likewise reduced, and then volatilized by the interior flame; peroxide of iron, which loses part of its oxygen in the interior flame; oxide of nickel, oxide of cobalt, peroxide of tin, which may be reduced by the interior flame. The following small number of oxides, on the contrary, are fusible when pure before the blowpipe: they are—oxide of antimony, which after fusion may be easily volatilized; oxide of bismuth, protoxide of lead, which like the preceding one may be reduced to the metallic state; and oxide of copper.

The degree of fusibility is a very important point to ascertain when the examination in question refers to the native combinations of silica and certain other minerals, for this characteristic feature displayed by the blowpipe is often the only one by which we may distinguish those which consist of earths, and which contain no notable quantities of metallic oxides, properly so called. In order to ascertain the degree of fusibility of minerals, the best way is to hold a fragment or splinter of the sample between the platinum points of a pair of forceps, and to expose it to the flame of the blowpipe. Amongst the minerals most frequently met with the following are infusible:—

Quartz,
Corundum,
Tourmaline (both that which contains alumina, and even that which contains soda),
Spinell,
Pleonast,
Gahnite,
Olivine,
Cerite,
Zircon,
Cyanite,
Phenakite,
Leucite,
Talc,
Pyrophyllite,
Apatite,
Gehlenite,
Antophyllite,
Staurodite,
Refractory clays,
Hydrate of alumina,
Hydrate of magnesia,
Sulphate of alumina,
Carbonate of lime,
Carbonate of magnesia,
Carbonate of zinc,
Allophane,
Cymophane,
Gadolinite (which being heated becomes suddenly luminous, as if it caught fire),
Vitreous tin,
Rutile,
Titanic iron,
Tantalite,
Turquoise,
Titaniferous oxide of iron,
Chrome iron,
Native oxides of iron,
Oxide of uranium,
Tantalite,
Yttrotantalite,
Dioptase,
Chondrodite,
Topaz.

Amongst those which are almost infusible and only become rounded at the edges the following may be named:—

Felspar,
Albite,
Petalite,
Labradorite,
Anorthite,
Nepheline,
Tabular spar,
Pyroxène (which contains much magnesia),
Meerschaum,
Soapstone (*pierre de lard*),
Serpentine,
Mica (some species, especially those found in agrnite),
Dichroite,
Epidote (which intumesces by the first impression of the heat),
Emerald,
Euclase (which intumesces by the first impression of the heat),
Titanite,
Sodalite,
Calcareous scheelin,
Heavy spar,
Celestine,
Gypsum,
Apatite,
Fluor spar.

The following are fusible:—

Zeolites (most of them intumesce),
Boracite,
Hydroboracite,
Spodumene (which intumesces),
Mejonite (which froths up before fusing),
Eleolite,
Amphibole (most of which boil up whilst in fusion),
Pyroxène (those which contain no excess of magnesia),
Idocrase (intumesees in fusing),
Garnet,
Cerine,
Orthite (boils in fusing),
Ferruginous scheelin,
Datolite,
Botryolite,
Cryolite,
Mica (several species, especially those which contain lithia),
Tourmaline (those which contain potash),
Axinite (intumesces whilst fusing),
Amblygonite,
Lazulite,
Haüyne,
Nosian,
Eudialite,
Pyrosmalite.

As to the salts which are soluble in water, most of them fuse when exposed to the flame of the blowpipe upon a charcoal support, but they are then very often decomposed by the charcoal, upon which they leave their base, when it is of an infusible nature, in the pure state. The salts of alkalis after fusion are absorbed by the charcoal, or form beads.

Among the insoluble salts several fuse into beads, which crystallize on cooling; this phenomenon is exhibited by phosphate of lead more strongly than by any other salt, and it consequently can thereby be easily recognised.

The changes of colour which substances undergo by the action of heat are generally owing to their being decomposed, and thus forming bodies of a different colour. There are some substances, however, which, without undergoing any change in their composition, assume a colour different from that which they have at the ordinary temperature; they afterwards gradually lose the tinge which they have thus acquired, and after complete cooling they reassume their original colour. Certain substances may therefore be thus accurately recognised, amongst which are the following:—

Oxide of zinc,
Titanic acid,
} which are white at the ordinary temperature, and of a lemon-yellow colour at a higher temperature, which phenomena are likewise observable in a great number of other substances of a white colour, but in none so distinctly as in these two.

Peroxide of lead,
Suboxide of mercury,
Chromate of lead,
} and a few other chromates, which at the ordinary temperature are yellow or red, but which become black at a higher temperature, though insufficient to decompose them.

There are many substances the ordinary colour of which becomes darker when they are heated; such are—

Protoxide of lead,
Oxide of bismuth.

The colour which certain substances impart to the flame of the blowpipe may often be the means of distinguishing them. We have already shown the important value of this reaction for the purpose of indicating the presence of alkalis in salts. The flame of the blowpipe exhibits likewise a change of colour when directed upon substances which contain strontia or lime, and also upon phosphates moistened with sulphuric acid, and borates treated in the manner described. A colour is likewise imparted to the flame of the blowpipe when employed to heat certain substances with reagents.

The decompositions which some substances experience both in the exterior and in the interior flame consist principally in this, that they become oxidized in the exterior flame, whilst the oxidized bodies are reduced by treatment in the interior flame. The changes produced by the exterior flame generally resemble those which bodies undergo when heated in the glass tube

open at both ends. It often happens, however, that substances are oxidized upon charcoal in the exterior flame, in order to be enabled to treat them more efficaciously afterwards by the appropriate reagents. Thus, for example, metallic sulphurets and arseniurets are roasted upon charcoal in the exterior flame, in order to separate the sulphur and the arsenic in the state of sulphurous and of arsenious acids, which decomposition or reaction is more readily effected with sulphurets than with arseniurets. The reduction of certain substances in the interior flame is generally effected in a better and more easy manner by mixing the substance with soda, and then heating it upon charcoal in the interior flame. The deportment of the various substances when so treated will be subsequently spoken of.—*Normandy's Translation of Rose's Chemistry.*

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON JAN. 3, 1849:—				
In London and vicinity, viz.:—				
St. John's, Southwark..	1	1		
In the country, viz.:—				
Sunderland	2	1	1	
Norhamshire District—Berwick-upon-Tweed Union.....	4			
The cases reported on the 1st inst., as having taken place at Leamington, occurred in the village of Offchurch, in the district of Radford.				
In Scotland, viz.:—				
Edinburgh	2	1	3	
Glasgow	184	78	46	
Dumbarton	4			
Dumfries	4	..	2	
Old Monkland	23	6	6	
Cardross	3	2		
Craie	1	1		
Campsie	1	1		
Jedburgh	20	6	10	
Total new cases.....	249	97	68	
In London and vicinity...	544	274	100	170
In the country	364	186	43	135
In Scotland	4104	1924	711	1469
Total	5012	2384	854	1774

GENERAL BILLS OF MORTALITY.

The Registrar-General's return of the births and deaths registered in the metropolis during the week ending Saturday, December 30, 1848, gives the number of deaths as 1,403, being 249 above the average of the last five years. The excess of deaths, however, above the average is chiefly due to an accumulation of coroners' cases, many of which occurred in former weeks, but were not registered till the end of the quarter. Scarlatina and typhus are the only epidemics which prevail to an excessive degree. The coroners' cases fell principally under violent and sudden deaths.

The deaths from cholera in the metropolis registered between September 23 and Saturday last amount to 479, of which 276 occurred on the south side of the Thames.

The following is a statement of the fatal cases of cholera registered during the week ending on Saturday last:--

PADDINGTON; St. John.—At 21, Upper Berkeley-street West, a clergyman, 26, "apoplectic paralysis (15 hours), cholera (12 hours), rheumatism (10 months), atrophy and nervous exhaustion (8 months)."

KENSINGTON; Town.—M. 8, "infantile cholera."

CHELSEA; South.—M. 4, "malignant cholera (64 hours)." North-West.—F. 48, cholera (21 hours);" F. 57, "natural, with symptoms of bilious cholera (18 hours)."—Inquest.

WEST LONDON; North.—At 3, Seacoal-lane, Farringdon-street, F. 38, "spasmodic cholera (11 hours)."

BETHNAL-GREEN; Church.—M. 7, "sudden death from cholera (12 hours)."—Inquest. F. 5, "sudden death from cholera (3 days)."—Inquest.

WHITECHAPEL; Church.—In London Hospital, M. 13, "natural; Asiatic cholera (12 hours)."—Inquest. Aldgate.—At Blue Anchor-yard, Rosemary-lane, M. 1, "Asiatic cholera."—Inquest. At Slater's-court, Rosemary-lane, M. 40, "natural death; Asiatic cholera."—Inquest. At Harebrain-court, Rosemary-lane, F. 60, "Asiatic cholera (4 hours)."—Inquest. At Harebrain-court, Rosemary-lane, F. 40, "natural death; Asiatic cholera."—Inquest.

ST. GEORGE-IN-THE-EAST; St. John.—At St. George's workhouse, son of a labourer, 2, "Asiatic cholera."

STEPNEY; Ratcliffe.—On board ship, M. 23, "natural death; sudden from English cholera (12 hours)."—Inquest. On board ship, M. 58, "sudden death from Asiatic cholera."—Inquest. On board ship, M. 52, "natural death from Asiatic cholera."—Inquest. Mr. Wells, the registrar, states that "the above three cases occurred between the 5th and 15th of October, but were not registered at that time, as the coroner's signature had not been received." Mile-end Old-town (Upper).—M. 56, "natural death; sudden from Asiatic cholera."—Inquest.

POPLAR; Bow and Bromley.—At Mary-street, Bromley, wife of a painter, 26, "cholera (23 hours)." Mr. Dunstan, the registrar, states that "the husband of the deceased attributes her death to the want of proper nourishment, he being at the time out of employment."

ST. OLAVE; St. John.—M. 55, "diarrhœa (4 days), cholera (3½ days)."

ST. GEORGE, SOUTHWARK; Kent-road.—At 3, Redcross-court, wife of a labourer, 38, "Asiatic cholera (26 hours)." At 119, Kent-street, wife of a tailor, 47, "English cholera (4 days)." Borough-road.—M. 58, "spasmodic cholera (32 hours)." (*Post-mort.*) Inquest. F. 4, "cholera (22 hours)."

NEWINGTON; St. Mary.—F. 29, "cholera (14 hours)." According to Mr. Young, the registrar, "the place where the above death occurred is very close and ill drained, and a common privy adjoins the small and badly-ventilated tenement. Deceased, who was wife of a master sweep and nightman, was not of very temperate habits. According to Mr. Nolan, the medical attendant, she suffered much from spasms, but, owing to the uncleanly condition in which she was found and allowed to remain, it was impossible to say whether the usual livid appearance of the skin formed in her case one of the symptoms, which in other respects were of a malignant character."

LAMBETH; Church (2d part).—M. 22, inmate of Lambeth workhouse, "natural death from cholera." Inquest. Mr. Wheatley, the registrar, states that "this man was seized in a court leading out of Glasshouse-street, Vauxhall, and was only admitted to the house a few hours before death, which occurred on the 30th of November, after severe suffering."

ROTHERHITHE; Rotherhithe.—M. 64, "spasmodic cholera (36 hours)."

WANDSWORTH AND CLAPHAM; Wandsworth. M. 4, "cholera (20 hours)." F. 9 months, "cholera infantum (4 days)." F. 42, "cholera (19 hours)."

THE CHOLERA IN BELFAST.—The Belfast papers of Wednesday state:—"We have pleasure in stating that, although this direful malady continues its progress, yet the comparative mortality is greatly diminished. At the time of our last publication the entire number of cases in Belfast was 36, and the deaths 19, showing a mortality of more than one half. Up to 3 p.m. yesterday the entire cases were 56, and deaths 23, under treatment 14, showing a considerable decrease even in the aggregate; but if we compare 20, the number of new cases, with 4, the number of deaths, it is evident that the mortality is diminished to one fifth. We deem it a matter of great importance to the public to ascertain how this can be accounted for. A medical friend informs us that the decrease is chiefly caused by the prompt attention which is now paid to the early symptoms of the malady. So little alarm was at first caused by the primary symptoms of the disease, that the sufferers were generally allowed to pass into a state of almost fatal collapse before medical aid was sought for. But now the ease is quite changed. We find that in the union workhouse the most effectual measures are taken, especially among the children, for discovering the very earliest symptoms; and we understand the poor of the town lose not a moment in applying for relief at the proper quarter. Of the above 56 cases, 49 were treated in the Union Hospital; 1 in the General Hospital, Frederick-street; and 6 in their own houses."

THE SANITARY STATE OF LEAMINGTON.—The Leamington people have taken much trouble to disprove the assertion that any cases of cholera have occurred in their town. The chairman of the board of commissioners for regulating and improving the town of Leamington Priors has addressed a communication to the General Board of Health, signed by eighteen resident medical practitioners, certifying, with reference to the statement of cases of cholera reported the 1st of January, 1849, which represented that seven cases and five deaths had occurred in Leamington, that not a single case of cholera does exist, or has existed, within the parish, and that such report is wholly incorrect and unfounded.

CHOLERA AT THE INFANT PAUPER ASYLUM, TOOTING.—We regret to announce the undisputed appearance of Asiatic cholera in this establishment. Up to the end of last week the children, upwards of 1,400 in number, exhibited a healthy appearance, when some of them were attacked with diarrhœa; several of the cases assumed the appearance of Asiatic cholera, and in a few cases death ensued in the space of three hours. Mr. Drouet, having informed the authorities of the several metropolitan parishes and unions, in order to lose no time, on his own responsibility procured the attendance of Dr. Addison, of Guy's Hospital. The authorities, with their medical officers, met this gentleman at Mr. Drouet's, and after a consultation the wards were visited, when 57 cases, of which 12 proved fatal, were found to have occurred. The patients were examined with the greatest attention, and, although each individual case did not exhibit all the appearances and forms of Asiatic cholera, still, taking the cases collectively, the medical gentlemen agreed in opinion that there was every symptom belonging to the malignant form of the disease. The bodies of the children turned perfectly blue after, and in some instances before, death. An inspection took place of the establishment, and an inquiry into the nature of the food, water, &c., given to the children was gone into, the result of which was greatly to the credit of Mr. Drouet. The opinion of the medical gentlemen was that the disease arose from atmospheric poison. The guardians of the unions and parishes have appointed permanent committees to visit and report. Information has also been forwarded to Somerset-house, and to Mr. Carter, the coroner for Surrey.

PARISIAN DENTIFRICE.—Take of powdered Florentine iris and Peruvian bark 4 ounces, 12 ounces of prepared chalk, 1 ounce of myrrh, 1⅓ ounce of rose pink, 16 minims of oil of cloves and oil of cinnamon. Mix.

GOLD IN CALIFORNIA.

The following are the latest accounts relative to this interesting subject. A recent traveller to California thus writes :—

"We reached San Francisco on the 20th, and found that all, or nearly all, its male inhabitants had gone to the mines. The town, which a few months before was so busy and thriving, was then almost deserted. On the evening of the 24th the horses of the escort were crossed to Sousoleto in a launch, and on the following day we resumed the journey by way of Bodega and Sonoma to Sutter's Fort, where we arrived on the morning of the 2d of July. Along the whole route mills were lying idle, fields of wheat were open to cattle and horses, houses vacant, and farms going to waste. At Sutter's there was more life and business. Launches were discharging their cargoes at the river, and carts were hauling goods to the fort, where already were established several stores, a hotel, &c. Captain Sutter had only two mechanics in his employ—a waggon-maker and a blacksmith, whom he was then paying 10 dollars a day. Merchants pay him a monthly rent of 100 dollars per room, and whilst I was there a two-story house in the fort was rented as a hotel for 500 dollars a month.

"On the 5th resumed the journey, and proceeded twenty-five miles up the American fork to a point on it now known as the Lower Mines, or Mormon Diggings. The hill sides were thickly strewn with canvass tents and bush arbours; a store was erected, and several boarding shanties in operation. The day was intensely hot, yet about 200 men were at work in the full glare of the sun, washing for gold—some with tin pans, some with close woven Indian baskets, but the greater part had a rude machine, known as the cradle. This is on rockers six or eight feet long, open at the foot, and at its head had a coarse grate, or sieve: the bottom is rounded with small cleets nailed across. Four men are required to work this machine; one digs the ground in the bank close by the stream; another carries it to the cradle, and empties it on the grate; a third gives a violent rocking motion to the machine, whilst a fourth dashes on water from the stream itself. The sieve keeps the coarse stones from entering the cradle, the current of water washes off the earthy matter, and the gravel is gradually carried out at the foot of the machine, leaving the gold mixed with a heavy fine black sand above the first cleets. The sand and gold mixed together are then drawn off through auger holes into a pan below; are dried in the sun, and afterwards separated by blowing off the sand. A party of four men, thus employed at the Lower Mines, averaged 100 dollars a day. The Indians, and those who have nothing but pans or willow baskets, gradually wash out the earth and separate the gravel by hand, leaving nothing but the gold mixed with sand, which is separated in the manner before described. The gold in the Lower Mines is in fine bright scales, of which I send several specimens.

"Remarkable success attended the labours of the first explorers, and in a few weeks hundreds of men were drawn thither. At the time of my visit, but little more than three months after its first discovery, it was estimated that upwards of four thousand people were employed. At the mill there is a fine deposit or bank of gravel, which the people respect as the property of Captain Sutter, although he pretends to no right to it, and would be perfectly satisfied with the simple promise of a pre-emption on account of the mill which he has built there at considerable cost. Mr. Marshall was living near the mill, and informed me that many persons were employed above and below him; that they used the same machines as at the lower washings; and that their success was about the same—ranging from one to three ounces of gold per man daily. This gold, too, is in scales a little coarser than those of the Lower Mines. From the mill Mr. Marshall guided me up the mountain on the opposite side or north-bank of the south fork, where, in the bed of small streams or ravines, now dry, a great deal of coarse gold has been found. I there saw several parties at work, all of whom were doing very well; a great many specimens were shown me, some as heavy as four or five ounces in weight, and I send three pieces, labelled No. 5, presented by a Mr. Spence. You will perceive that some of the specimens accompanying this hold mechanically pieces of quartz, that the surface is rough, and evidently moulded in the crevice of a rock. This gold cannot have been carried far by water, but must have remained near where it was first deposited from the rock that once bound it. I inquired of many if they had encountered the metal in its matrix, but in every instance they said they had not, but that the gold was invariably mixed with washed gravel, or lodged in the crevices of other rocks. All bore testimony that they had found gold in greater or less quantities in the numerous small gullies or ravines that occur in that mountainous region. On the 7th of July I left the mill, and crossed to a small stream emptying into the American fork, three or four miles below the saw-mill. I struck the stream (now known as Weber's Creek) at the washings of Sunol and Co. They had about thirty Indians employed, whom they pay in merchandise. They were getting gold of a character similar to that found in the main fork, and doubtless in sufficient quantities to satisfy them. I send you a small specimen presented by this company of their gold. From this point we proceeded up the stream about eight miles, where we found a great many people and Indians, some engaged in the bed of the stream and others in the small side valleys that put into it. These latter are exceedingly rich, and two ounces were considered an ordinary yield for a day's work. A small gutter, not more than 100 yards long by four feet wide, and two or three feet deep, was pointed out to me as the one where two men—William Day and Perry M'Coon—had a short time before obtained 17,000 dollars worth of gold. Captain Weber informed me that he knew that these two men had employed four white men and about 100 Indians, and that at the end of one week's work they paid off their party, and had left 10,000 dollars' worth of this gold. Another small ravine was shown me from which had been taken upwards of 12,000 dollars' worth of gold. Hundreds of similar ravines, to all appearance, are as yet untouched. I could not have credited these reports had I not seen in the abundance of the precious metal evidence of their truth. Mr. Neligh, an agent of Commodore Stockton, had been at work about three weeks in the neighbourhood, and showed me in bags and bottles over 2,000 dollars' worth of gold; and Mr. Lyman, a gentleman of education, and worthy of every credit, said he had been engaged with four others with a machine on the American fork, just below Sutter's mill; that they worked eight days, and that his share was at the rate of 50 dollars a day; but, hearing that others were doing better at Weber's-place, they had removed there, and were then on the point of resuming operations. I might tell of hundreds of similar instances; but, to illustrate how plentiful the gold is in the pockets of common labourers, I will mention a similar occurrence which took place in my presence when I was at Weber's store. This store was nothing but an arbour of bushes, under which he had exposed for sale goods and groceries suited to his customers. A man came in, picked up a box of Seidlitz powders, and asked its price. Captain Weber told him it was not for sale. The man offered an ounce of gold, but Captain Weber told him it only cost 50 cents, and he did not wish to sell it. The man then offered an ounce and a half, when Captain Weber had to take it. The prices of all things are high, and yet Indians, who before hardly knew what a breech-cloth was, can now afford to buy the most gaudy dresses.

"The country on either side of Weber's Creek is much broken up by hills, and is interseeted in every direction by small streams or ravines, which contain more or less gold. Those that have been worked are barely scratched, and, although thousands of ounces have been carried away, I do not consider that a serious impression has been made upon the whole. Every day was developing new and richer deposits; and the only impression seemed to be that the metal would be found in such abundance as seriously to depreciate in value.

"On the 8th of July I returned to Monteroy. Before leaving Sutter's I satisfied myself that gold existed in the bed of the Feather River, in the Yubah and Bear, and in many of the small streams that lie between the latter and the American fork; also that it had been found in the Cossumes to the south of the American fork. In each of these streams the gold is found in small scales, whereas in the intervening mountains it occurs in coarser lumps. Mr. Sinclair, whose rancho is three miles above Sutter's on the north side of the American, employs about fifty Indians on the north fork, not far from its junction with the main stream. He had been engaged about five weeks when I saw him, and up to that time his Indians had used simply closely-woven willow baskets. His net proceeds (which I saw) were about 16,000 dollars' worth of gold. He showed me the proceeds of his last week's work—fourteen pounds avoirdupois of clean-washed gold. The principal store at Sutter's Fort, that of Brannan and Co., had received in payment for goods 36,000 dollars' worth of this gold from the 1st of May to the 10th of July. Other merchants had also made extensive sales. Large quantities of goods were daily sent forward to the mines, as the Indians, heretofore so poor and degraded, have suddenly become consumers of the luxuries of life. I before mentioned that the greater part of the farmers and rancheros had abandoned their fields to go to the mines. This is not the case with Captain Sutter, who was carefully gathering his wheat, estimated at 40,000 bushels. Flour is already worth at Sutter's 36 dollars a barrel, and soon will be 50. Unless large quantities of bread-stuff reach the country much suffering will occur; but, as each man is now able to pay a large price, it is believed the merchants will bring from Chili and Oregon a plentiful supply for the coming winter.

"The most moderate estimate I could obtain from men acquainted with the subject was, that upwards of 4,000 men were working in the gold district, of whom more than one half were Indians, and that from 30,000 to 50,000 dollars' worth of gold, if not more, was daily obtained. The entire gold district, with very few exceptions of grants made some years ago by the Mexican authorities, is on land belonging to the United States. It was a matter of serious reflection with me how I could secure to the Government certain rents or fees for the privilege of procuring this gold; but upon considering the large extent of country, the character of the people engaged, and the small scattered force at my command, I resolved not to interfere, but to permit all to work freely, unless broils and crimes should call for interference. I was surprised to learn that crime of any kind was very unfrequent, and that no thefts or robberies had been committed in the gold district. All live in tents, in bush arbours, or in the open air; and men have frequently about their persons thousands of dollars' worth of this gold, and it was to me a matter of surprise that so peaceful and quiet a state of things should continue to exist. Conflicting claims to particular spots of ground may cause collisions, but they will be rare, as the extent of the country is so great, and the gold so abundant, that for the present there is room and enough for all. Still the Government is entitled to rents for this land, and immediate steps should be devised to collect them, for the longer it is delayed the more difficult it will become. One plan I would suggest is, to send out from the United States surveyors with high salaries, bound to serve specified periods; a superintendent to be appointed at Sutter's Fort, with power to grant licences to work a spot of ground—say 100 yards square—for one year, at a rent from 100 dollars to 1,000

dollars, at his discretion; the surveyors to measure the ground, and place the renter in possession. A better plan, however, will be to have the district surveyed, and sold at public auction to the highest bidder, in small parcels—say from twenty to forty acres. In either case there will be many intruders, whom for years it will be almost impossible to exclude.

"The discovery of these vast deposits of gold has entirely changed the character of Upper California. Its people, before engaged in cultivating their small patches of ground, and guarding their herds of cattle and horses, have all gone to the mines, or are on their way there. Labourers of every trade have left their work-benches, and tradesmen their shops. Sailors desert their ships as fast as they arrive on the coast, and several vessels have gone to sea with hardly enough hands to spread a sail. Two or three are now at anchor in San Francisco with no crew on board. Many desertions, too, have taken place from the garrisons within the influence of these mines; 26 soldiers have deserted from the post of Sonora, 24 from that of San Francisco, and 24 from Monterey. For a few days the evil appeared so threatening that great danger existed that the garrisons would leave in a body; and I refer you to my order of the 25th of July to show the steps adopted to meet this contingency. I shall spare no exertions to apprehend and punish deserters, but I believe no time in the history of our country has presented such temptations to desert as now exist in California. The danger of apprehension is small, and the prospect of high wages certain; pay and bounties are trifles, as labouring men at the mines can now earn in one day more than double a soldier's pay and allowances for a month; and even the pay of a lieutenant or a captain cannot hire a servant. A carpenter or mechanic would not listen to an offer of less than 15 or 20 dollars a day. Could any combination of affairs try a man's fidelity more than this? And I really think some extraordinary mark of favour should be given to those soldiers who remain faithful to their flag throughout this tempting crisis. No officer can now live in California on his pay, money has so little value; the prices of necessary articles of clothing and subsistence are so exorbitant, and labour so high, that to hire a cook or servant has become an impossibility, save to those who are earning from 30 to 40 dollars a day. This state of things cannot last for ever. Yet, from the geographical position of California, and the new character it has assumed as a mining country, prices of labour will always be high, and will hold out temptations to desert. I therefore have to report, if the Government wish to prevent desertions here on the part of the men, and to secure zeal on the part of officers, their pay must be increased very materially. Soldiers, both of the volunteer and regular service, discharged in this country, should be permitted at once to locate their land warrants in the gold district. Many private letters have gone to the United States giving accounts of the vast quantity of gold recently discovered, and it may be a matter of surprise why I have made no report on this subject at an earlier date. The reason is, that I could not bring myself to believe the reports that I heard of the wealth of the gold district until I visited it myself. I have no hesitation now in saying that there is more gold in the country drained by the Sacramento and San Joaquin Rivers than will pay the cost of the present war with Mexico a hundred times over. No capital is required to obtain this gold, as the labouring man wants nothing but his pick, and shovel, and tin pan, with which to dig and wash the gravel; and many frequently pick gold out of the crevices of rocks with their butcher-knives, in pieces of from one to six ounces.

"Mr. Dye, a gentleman residing in Monterey, and worthy of every credit, has just returned from Feather River. He tells me that the company to which he belonged worked seven weeks and two days, with an average of fifty Indians (washers), and that their gross product was 273 lb. of gold. His share (one seventh), after paying all expenses, is about 37 lb., which he brought with him, and exhibited in Monterey. I see no labouring man from the mines who does not show his 2lb., 3lb., or 4lb. of gold. A soldier of the Artillery Company returned here a few days ago from the mines, having been absent, on furlough, twenty days. He made, by trading and working during that time, 1,500 dollars. During those twenty days he was travelling ten or eleven days, leaving but a week, in which he made a sum of money greater than he receives in pay, clothes, and rations, during a whole enlistment of five years. These statements appear incredible, but they are true:—'Gold is also believed to exist on the eastern slope of the Sierra Navada; and, when at the mines, I was informed by an intelligent Mormon that it had been found near the Great Salt Lake by some of his fraternity. Nearly all the Mormons are leaving California to go to the Salt Lake; and this they surely would not do unless they were sure of finding gold there in the same abundance as they now do on the Sacramento.' 'The gold "placer," near the mission of San Fernando, has long been known, but has been little wrought for want of water. This is in a spur that juts off from the Sierra Navada (see Fremont's map), the same in which the present mines occur. There is, therefore, every reason to believe that in the intervening spaces of 500 miles (entirely unexplored) there must be many hidden and rich deposits. The "placer" gold is now substituted as the currency of this country; in trade it passes freely at ten dollars per ounce; as an article of commerce its value is not yet fixed. The only purchase I made was of the specimen No. 7, which I got of Mr. Neligh at twelve dollars the ounce. That is about the present cash value in the country, although it has been sold for less. The great demand for goods and provisions made by this sudden development of wealth has increased the amount of commerce at San Francisco very much, and it will continue to increase.'"

Further accounts confirm, in every important particular, the testimony hitherto received. A letter, under date of San Francisco, October 12, 1848, states:—

"I have little to add to my last, containing a full note of sales to date. I am selling off slowly the heavy part of my cargo, viz., brown shirting, ticks, kremlins, stripes, ducks, Russia sheeting, hardware, &c. All these articles are wanted. The attention of the whole population is entirely devoted to the gold region. They are going to and fro continually, taking up goods and bringing down gold dust in payment for their purchases. Much sickness prevails, and many die, as much from want of medical attendance and good nursing as from disease; but the truth is, they are so entirely absorbed by the mania for gold that they care nothing for comfort, and submit to every privation. You may believe the most extravagant reports of the abundance of gold on the Sacramento—it is to be had for digging. Some dig in water, others in what is called 'dry diggings'—but all are successful, and value money but little. Packages of goods are exposed for days for want of room and labourers to store them, but this is attended with but little if any risk, owing to the general good conduct of the people. Since I have been here I have not heard of a single breach of the peace. I hope to close my business in a month, and by that time the rainy season will probably drive sailors down to the port,—at present they are not to be had. I do not think much change will take place in prices for articles particularly wanted, unless the supply should be very heavy. The emigration will be large, and their wants must be supplied. Pork has been sold, to arrive from Columbia River, at 60 dollars per barrel. After I despatch the ship from Valparaiso, I shall return here and establish myself in a general commission business, in connection with the two young gentlemen."

A Mr. Cutting, himself direct from California, where he has been engaged in gold-hunting, states that, to all appearances, too, the supply is inexhaustible, nor has the extent of country stocked with gold been exaggerated. The largest piece of native gold Mr. Cutting has known to be found weighed 13lb. He was not so fortunate as to pick it up. He has known men well who have picked up 1,800 dollars, 1,500 dollars, and 1,200 dollars in a single day, but those were extreme cases of good fortune. The editor of the *Californian*, in his paper of the 7th of October, announces that in the neighbourhood of Los Angelos recent explorations have brought gold to light in quantities as abundant as on the American fork, and exclaims, we doubt not in all sincerity, "Really, we dread the digging of a well or the grading of a street in our neighbourhood."

MISCELLANEA.

St. Thomas's Hospital.—A *conversazione* was held at this hospital on Wednesday evening, at which Mr. Grainger delivered an address on the sanitary question, especially in relation with epidemic cholera. Mr. Grainger stated that it had been satisfactorily determined by the researches of the Metropolitan Sanitary Commission (in whose labours he has taken an active share) that the cholera closely follows the *habitat* of fever, and that the districts which, before the arrival of the cholera, had been the seats of fever were those in which the cholera seized the greater proportion of its victims. As in fever, so also in cholera, a medical man could at once put his finger upon the districts which would become the seat of cholera, by selecting those districts in which pestilential ditches, bad sewerage, and ill-constructed and over-crowded houses most abounded. There could be no doubt whatever that the introduction of sanitary measures effectually checked the progress of typhus and continued fever; and so little contagious was fever of this kind, in his opinion, and that of almost all the intelligent country practitioners who saw and treated it in a pure atmosphere, that it was to be expected in the course of human progress and civilization that typhus and continued fever would ere long be eradicated. The cholera appeared to be capricious in its progress, but in reality obeyed the known laws of an epidemic, and not a contagious disease. It not only followed the same habitat as fever, but it attacked the same classes of the community, and even persons of the same age, the greater proportion of cholera patients being, as in fever cases, between twenty and forty years of age. In St. Petersburg, out of 23,000 persons attacked with cholera, 17,000 were between eighteen and forty. The district in the city of Hamburg which suffered most from cholera in 1832 was burned down at the great fire in that city. Previous to that event it had been the embouchure of many of the city drains and ditches, but at the rebuilding of the city subsequent to the fire this district was thoroughly drained, and the sewers had since been most plentifully supplied with water. The result was, that although this district in 1832 had furnished the chief proportion of cases within the city, not one in ten of the recent cholera cases had occurred in that quarter. Here it was clear that nine tenths of the cholera in Hamburg had been eradicated by sanitary improvements. Having at some length, and by a great variety of instances, supported his position that the cholera obeyed the known laws of epidemic disease, Mr. Grainger adverted to the ravages of the cholera in Scotland, and showed that there were special reasons why it should rage with greater severity in Coatbridge and Glasgow than in other places, in consequence of the pestilential ditches, noisome smells, and overcrowding of the houses in those towns. In Glasgow there had been returned 120 to 140 cases per day, and probably many more had not been reported. The hearse was moving through the streets of Glasgow as through the city of the plague, and a great number of the higher ranks had fallen victims to the disease. Mr. Grainger then alluded to the diarrhœa, twitchings of the legs,

and other premonitory symptoms of cholera, which he said usually attacked the whole of the population where the cholera was rife, and which he had discovered had extensively prevailed in the district of Whitechapel when the cholera was at its height. This was the curable state of the disease. After some observations on the treatment and pathology of cholera, Mr. Grainger congratulated his audience on the growing public interest taken in sanitary improvement, as evinced by the fact that the inhabitants of ninety towns had already applied for the provisions of the Public Health Bill to be extended to them, and concluded his very able address amid loud applause.

Royal Arsenal, Woolwich, Jan. 3.—We recently recorded some experiments going on at Woolwich, relative to the firing of double-shot charges. The experiments have now concluded. After firing ten rounds, with charges of 23lb. of powder each round, and two hollow 56-pounder shot each time, the gun appeared perfectly sound on being examined. The result of the experiments being so successful, the authorities decided on having the gun tried with solid shot, commencing with a charge of 20lb. of powder each round. The gun stood the first and second rounds with 20lb. of powder and two solid shot of 68lb. each remarkably well, but on the third round being fired with a similar charge it burst, the fragments both of the gun and the timbers being dispersed in all directions. Several large splinters struck the new two-gun battery erecting by Mr. Kerrige with his composition, but they did not appear to have injured it. The result of the experiments with the 8-inch gun are of a most satisfactory nature, and will give great confidence to all who use these guns with the heavy double charges proposed by Captain Chads.

On the Prescription of Medicines in Large Doses.—The Prussian Government, acting upon the proposition of the Berlin College of Medicine, has just instituted a measure having for its object the prevention of danger from errors which may occur in medical prescriptions, in consequence of unusally large doses of medicines being ordered. The Council of Health has determined the maximum dose of those medicines which a pharmacien may send out to the order or prescription of a physician; but, when a physician thinks proper to exceed this legalized dose, he must expressly state his intention by putting after the large dose a note of exclamation, thus! The pharmacien who delivers a greater dose than the legalized one without this formality is subject to a fine of 80 to 100 francs. This measure seems, remarks a French contemporary, very useful, and would frequently remove from the pharmacien a great source of perplexity; but the sign adopted by Prussia does not appear to us sufficient. We would propose, says our contemporary, to substitute the word sic underlined, and placed in a parenthesis. Thus:—

℞ Extract of belladonna, 1 gramme (sic).
Powder of guimauve, 1 gramme.
Simple syrup, q.s.
Fiant bol. xx.

To Etch on Glass the ground is laid on, and the design scratched out in the usual way. Liquid hydrochloric acid is now applied, or, which is still better, the glass is exposed to the action of hydrofluoric acid gas. The former renders the surface of the etching transparent, the latter opaque. A very simple way of performing this operation consists in wetting the design with sulphuric acid, and then to sprinkle on some finely-pulverized fluor spar (fluoride of calcium), by which means hydrofluoric acid is set free and attacks the glass. This may be very easily applied to the graduation of glass vessels, thermometer-tubes, &c. A most rapid and useful method of etching on iron or steel is as follows:—Warm the metal until it is capable of melting a piece of beeswax, or etching varnish, which must then be carefully rubbed over it, so as to form a thin and even coating; allow the whole to cool, and scratch out the design in the common way, with a needle or point; then sprinkle on a little powdered iodine, and at the same time add a few drops of water with a camel-hair pencil, and work them into a liquid paste, which must be moved about over the intended engraving, for a period varying from one to five minutes, according to the depth of lines required to be produced. Afterwards wash the whole in clean water. Persons acquainted with the properties of iodine will readily perceive that the same etching-paste, by being kept for a few days, will again acquire the property of dissolving iron. The same materials may be thus successfully employed three or four times. Iodine (remarks a recent author) will, doubtless at no very distant period, supersede the use of acids for the above purpose, on account of its portability and convenience.

Lithographic Ink.—Take mastic in tears 8 ounces, shell lac 12 ounces, Venice turpentine 1 ounce, melt together; add wax 1 pound, tallow 6 ounces; when dissolved, add hard soap in shavings 6 ounces; and, after combination of the preceding has been effected, add 4 ounces of lampblack. Melt all accurately.

Soubeiran's Royal Essence.—A cordial: a few drops being taken with sugar and water. Take of ambergris 2 scruples, musk 1 scruple, civet and carbonate (subcarbonate) of potash of each 10 grains, oil of cinnamon 6 drops, oil of rhodium and otto of roses of each 4 drops, rectified spirits of wine 4 fluid ounces. Macerate for a fortnight.

Chalk and Pencil Drawings may be fixed—(1.) By drawing them through a saucer containing skim milk. (2.) By holding their reverses against the steam from the spout of a kettle. (3.) By painting their reverses with a solution of mastic (very thin) in spirits of wine, or by using pure oil of turpentine in a similar manner.

TO CORRESPONDENTS.

"Mr. Alfred Gyde" thus addresses us:—"As I see by your notice to subscribers that you intend to charge 26s. per annum for the future, allow me to inquire the amount of matter we may expect for that sum? During the early existence of the *Times* we had twenty pages weekly for 21s., equal to the *Medical Times*. It was subsequently reduced to fourteen pages, without any reduction in price; and, if the paper is now to be 26s., your subscribers will feel an interest in knowing the amount of talent and matter they may in future expect for that sum. Your reply, addressed A. G., in your notices to correspondents, will oblige your obedient servant, Alfred Gyde." We purpose very soon enlarging the *Chemical Times* to the original size of the *Pharmaceutical Times*, and will spare neither trouble nor expense to render it valuable to every class of our readers.

"Mr. Richard Burnetson" next week.

"A Constant Reader" sends us the following note:—"Sir,—The Corporation of Leeds, of which I am a member, having obtained a new sewage bill for the borough, are anxious to carry it out to the greatest advantage to the town; and the reason I now trouble you is simply to ask your direction to the best source of information for the disposition of the sewage manure. I have seen quoted on the subject some report of Mr. Aikin, I think, which contains a good deal of information to the point, but where to meet with it I cannot tell. You have, I understand, two Sewage Manure Companies in your city. Can you inform me where I can meet with any report as to the system adopted by them, or any financial statement as to their prosperity as a company? We want to know the best way of preparing the manure, and whether it can be done with profit or not. Your reply to the above will greatly oblige one of your first subscribers and A Constant Reader." Some of our correspondents will doubtless answer the queries.

"Petrarch" wishes to be informed how it is that coal-gas manufacturers can effect a fraud on the community by merely applying an excess of heat? We have already explained this matter chemically; we will now endeavour to do so popularly. If our correspondent had to buy hay for his horses by measure, would he not prefer (the prices being equal) to purchase such as had been compressed into the smallest space? Suppose chemical affinity to stand in place of mechanical compression, and we have an analogy in coal-gas, which may be heavy, or it may be light; excessive heat, by causing the former to expand, changes it into the latter, and this expansion is permanent. Now, inasmuch as a cubic foot of light gas will affect a meter equally with an equal measure of that which is heavy, the nature of the fraud will be evident. The same correspondent directs our attention to the injury he fancies may arise from the presence of shot in game, &c., on account of the arsenic which shot always contains. His fears on this subject are imaginary. His other suggestions shall be attended to in time. Unfortunately we have not space enough to attend to the various requests of our correspondents.

"A Constant Reader" is informed that the lectures in question being intended chiefly for juveniles, and embodying the mere outlines of a generally well-known branch of chemistry, their appearance in the *Chemical Times* would displace more valuable matter.

"J. S." thus addresses us:—"In the answers to correspondents in No. 108 of the *Pharmaceutical Times* are the following lines:—'Dumas' lectures will be resumed early in October, and continued without further interruption.' I presume you meant early in October, 1849, as I have looked anxiously for them since the beginning of October, 1848, without being able to find them. I should not have troubled you with this epistle, but, the above being the second promise of their early resumption since they were discontinued without being fulfilled, I have almost begun to despair of seeing them finished. If being a purchaser from the commencement of your excellent publication gave one a right to advise, my advice to you would be never to begin a series of papers on any subject unless you could publish them continuously to the end, as it is not only annoying to the reader, but detracts much from the value of a work when they are discontinued, if only for a limited time. Please to say how soon you will be enabled to resume the lectures." How often will it be requisite for us to disclaim any connection with the *Pharmaceutical Times*, or any responsibility for its promises or acts? Our promises shall be kept. The suggestion about the reappearance of the course by Dumas shall receive consideration. We thank our correspondent for his advice, which is intrinsically good, and well meant.

The following errata have been discovered in Mr. Thornton J. Herapath's paper on the superphosphate of lime:—

In note to first column of page 87, for "139.77" read "169.77."

In second column of same page, 29 lines from top, for "greater and" read "greatest."

In second table in same page, for "12 1-5" read "$12\frac{1}{5}$."

In note appended to same column, for "Mr. Hannane's" read "Mr. Hannam's."

In last column of same page, 26 lines from bottom, for "phosphalic" read "phosphatic."

Also 7 lines from bottom, for "alkaline salt" read "alkaline salts."

"A Lady."—Essence of jasmine is made as follows:—Stratify the fresh flowers with cotton wool dipped in oil of benzoin or nut oil, and kept in a close vessel in a warm place. This process is repeated with fresh flowers, but the same cotton, until the latter is strongly impregnated with the perfume. The perfumed cotton is then distilled from a water-bath with alcohol. It may be imitated by mixing 1 ounce of essence of violets with 1 drachm of essence of bergamot.

"A Lincolnshire Apprentice."—Genuine euphorbium ought never to possess a less specific gravity than 1.129.

"Mr. J. Stephens."—The following is the formula for liquid soap:—Take 1 pound of the best Castile soap, scrape it very fine, and put it into a gallon of spirits of wine, with half an ounce of oil of rosemary or lavender. Allow the bottle to stand in the sun's rays for ten or twelve days, taking it in at night, and shaking it till the soap be dissolved. Filter through cotton. If properly made it will be transparent.

"Mr. S. Law."—There are various preparations called milk of roses. The French compound of this name is made by adding 4 ounces of the liquor plumbi diacetatis to half a pint of rose-water. But the following is, perhaps, better:—Take 1 ounce each of oil of almonds and of Castile soap, 2 drachms each of oil of lavender, white wax, and spermaceti, 1 pint of spirits of wine, and 2½ quarts of rose-water, and 12 ounces of Jordan almonds; put all these into a jar, with 1 ounce of monocarbonate of potash dissolved in 2 drachms of warm water; shake the whole well, and bottle for use.

"A Pharmaceutical Assistant."—"The Treatise of Practical Pharmacy" by Mohr and Redwood is the only book of its kind in English, and one which you should not be without.

"A Perfumer."—The so-called Dupuytren's pomatum is a mixture of almond oil, lard, and prepared suet.

"Mr. Nicholas Kennedy."—Elemi is often adulterated with inferior gum resins, but may be known to be genuine from its peculiar odour, and a yellow or greenish semi-transparent appearance.

"A Valetudinarian."—The aromatic plaster of the Dublin Pharmacopœia is thus composed:—Take 3 ounces of frankincense, ½ ounce of yellow wax, 6 drachms of powdered cinnamon, 2 drachms each of essential oil of pimento and of lemons. Melt the frankincense and wax together, and strain; and while it cools add the cinnamon, previously triturated with the oils, to form a plaster.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—January 6, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,*
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture V.

The constitution of nitrobenzoic acid, according to the theory of substitution set forth in my last lecture, is :—

$$C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_3$$

and, therefore, it may be considered as perfectly analogous to chlorobenzoic acid, the simple radical chlorine substituting the compound radical, peroxide of nitrogen. In a similar way we have chloro, bromo, and nitro salicylic acids,

Salicylic acid ..... $C_{14}H_5O_5$
Chlorosalicylic acid $C_{14}\left\{\begin{matrix}H_4\\Cl\end{matrix}\right\}O_5$
Bromosalicylic acid $C_{14}\left\{\begin{matrix}H_4\\Br\end{matrix}\right\}O_5$
Nitrosalicylic acid . . $C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5$

We now come to the most interesting product of the series, one which has furnished a field for hundreds of chemists to work upon. I mean benzol, discovered first by Faraday among the products of the destructive distillation of organic substances. Benzol, like elayle, is a product from the dry distillation of many rich carbohydrogens. It was found by Faraday in oil gas. According to Ohme the vapour of oil of bergamot, when passed over incandescent lime, yields benzol in small quantity. All substances affording benzoic acid furnish benzol distilled with an excess of lime. The best method for obtaining benzol is to distil, in a copper retort, one part of benzoic acid with three parts of slacked lime.

DECOMPOSITION.

One equivalent of benzoic acid .... $C_{14}H_6O_4$
Minus two equivalents carbonic acid C_2O_4 } combines with the lime

Yields.. $C_{12}H_6$ Benzol.

In some recent experiments I distilled two pounds of benzoic acid with six pounds of hydrate of lime, and obtained a nearly colourless fluid, which, on being redistilled, yielded fifteen ounces of benzol. When purified by repeated distillations with potassa, the benzol is procured as a limpid iridescent fluid, possessing a most agreeable ethereal odour, insoluble in water, but copiously dissolved by alcohol and ether. In ice it solidifies into a crystalline dentritical mass. It has neither acid nor basic properties. Boiling point, 86°. Sulphuric acid, with a sp. gr. of 1.95, has no action whatever upon benzol; but, if the same mixed with fuming acid is brought in contact with benzol, two compounds are formed, sulphobenzide and hyposulphobenzidic acid, the latter, with copper and baryta, giving beautiful and well-defined crystalline salts. The formulæ are as follows :—

Sulphobenzide ..... $C_{12}H_5SO_2$
Hyposulphobenzidic acid $C_{12}H_5S_2O_5$

The second may be regarded as a compound of the former and sulphuric acid :—

$$C_{12}H_5SO_2 + SO_3$$

Strong hydrochloric acid does not decompose benzol. Nitrobenzol is formed when benzol is added drop by drop to fuming nitric acid. A better method, however, is to distil repeatedly nitric acid and benzol. The action is extremely brisk. On diluting with water an oily fluid of a golden-yellow colour separates. This body possesses a sweet taste and an odour analogous to cinnamon. Nitrobenzol is decomposed by distillation, is nearly insoluble in water, but dissolves speedily in alcohol and ether. An ammoniacal alcoholic solution, if treated for a long time with hydrosulphuric acid gas, gives that most interesting body, aniline, which has made the name of Hofmann so conspicuous in the scientific world. The annexed equation represents the above-mentioned decomposition :—

$$C_{12}H_5NO_4 + 6HS = C_{12}H_7N + 4HO + 6S$$

A characteristic method for the detection of benzol in organic distillates is its conversion into aniline. Heat the menstruum with strong nitric acid, then add zinc and sulphuric acid to generate nascent hydrogen, which will convert the nitrobenzol into aniline :—

$$C_{12}H_5NO_4 + 6H, = C_{12}H_7N + 4HO$$

Shake up with ether to extract any aniline formed, dispel the ether, and add to the oily residue hypochlorate of lime. If the smallest trace of aniline be present a magnificent purple colour immediately appears. Many opportunities occur to me of using the above-mentioned test, and in all investigations in the benzol type of compounds it is most infallible. Aniline is obtained in large quantities by acting upon indigo with potassa.

The action of potassa on indigo is a true process of oxidation. According to the duration of the action and the state of concentration of the alkali, various products are formed, a greater or less number of equivalents of carbon being oxidized at the expense of the water, the hydrogen of which partly escapes and partly enters into new combinations. Anthranilic acid is first formed :—

$$\underset{\text{Indigo.}}{C_{14}H_5NO_2} + 2KO + 6HO =$$
$$\underset{\text{Anthranilic acid.}}{C_{14}H_7NO_4} + 2(KO, CO_2) + 4H$$

and by prolonging the action it is resolved into carbonic acid and aniline—

$$\underset{\text{Anthranilic acid.}}{C_{14}H_7NO_4} + 2KO =$$
$$2(KO, CO_2) + \underset{\text{Aniline.}}{C_{12}H_7N}$$

Aniline can be procured from a great many substances; and in course of time it will be found in the products of distillation of a still greater number of bodies. Dr. Blyth obtained aniline several times in his investigations on styrol from storax gum. It is also produced in the toluol type of substances. Toluol obtained from the balsam of Tolu,* when acted upon by strong nitric acid, gives nitrotoluide :—

$$\underset{\text{Toluol.}}{C_{14}H_8} + NO_5 = \underset{\text{Nitrotoluide.}}{C_{14}H_7NO_4} + HO$$

Nitrotoluide, when passed over lime heated to incipient redness, yields aniline :—

$$\underset{\text{Nitrotoluide.}}{C_{14}H_7NO_4} + 2CaO = \underset{\text{Aniline.}}{C_{12}H_7N} + 2(CaO, CO_2).$$

Again, when the oil of Gaultheria procumbens is saturated with ammoniacal gas, salicylamide is produced, which with lime affords aniline :—

$$\underset{\text{Salicylamide.}}{C_{14}H_7O_4N}, \text{ or } \underset{\text{Salicylamide.}}{C_{14}H_5NH_2} + 2CaO =$$
$$\underset{\text{Aniline or Phenamide.}}{C_{12}H_7N}, \text{ or } C_{12}H_5NH_2 + 2(CaO, CO_2)$$

Aniline is generated when nitrobenzide is distilled with an alcoholic solution of potassa, collaterally with Mitcherlich's azobenzol :—

$$2(\underset{\text{Nitrobenzol.}}{C_{12}H_5NO_4}) + \underset{\text{Alcohol.}}{C_4H_5O, HO}$$

Equal

$$\underset{\text{Aniline.}}{C_{12}H_7N} + \underset{\text{Azobenzol.}}{C_{12}H_5N} + \underset{\text{Oxalate of water.}}{2HO\ C_2O_3} + 2\ Aq$$

The preceding examples are given to show the variety of the sources of this most interesting of all the organic bases.

Pure aniline, best obtained by decomposing the oxalate, possesses an oily consistence, an agreeable odour, and an aromatic and somewhat styptic taste. It is not solidified at a temperature of 16°, nor does it lose anything of its mobility. Highly volatile, as the stain it imparts to paper vanishes almost instantaneously. Its boiling point is 182°, and its sp. gr. 1.020. It is copiously dissolved by ether, alcohol, pyroxilic spirit, acetone, aldehyde, bisulphide of carbon, and the fatty and essential oils. Aniline is not a conductor of electricity. Its physiological properties are worthy of note, and they will no doubt interest the medical portion of your readers.

Leeches are immediately killed when immersed in an aqueous solution of aniline; and when a rabbit is injected with half a gramme of the oil violent spasms are the consequence. The pupil of the eye becomes dilated, succeeded by the most violent spasmodic affections, similar to those produced in narcotized frogs.

The principal reactions of aniline are very characteristic. I have mentioned to you that its presence may be infallibly detected by a solution of hypochlorate of lime. If a drop of this liquid be added to a solution containing a mere trace of aniline, a beautiful violet colour appears. This is sometimes the case when the anhydrous base is mixed with fuming nitric acid; but if the mixture be greatly warmed the blue colour becomes yellow, accompanied by an extraordinary evolution of heat, amounting often to an explosion. The liquid, cameleon-like, passes through every shade of colour to the most intense scarlet. As it refrigerates, reddish tabular crystals of carbazotic acid appear :—

1 equiv. of aniline ..... $C_{12}H_7N$,
6 equivs. of nitric acid ..... N_6O_{30}

Equal. .. .. $C_{12}H_7N_7O_{30}$

The above elements split into one equivalent of carbazotic acid, four equivalents of nitrous acid, and four of water :—

1 equiv. of carbazotic acid . .... $C_{12}H_3N_3O_{14}$
4 equivs. of nitrous acid ..... N_4O_{12}
4 equivs. of water ..... H_4O_4

$C_{12}H_7N_7O_{30}$

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XL.

(LECTURE LXVIII.)

AQUEOUS EXTRACTS.

The extracts of succulent plants are generally prepared with the expressed juices of the fresh plants, in preference to the treatment of the dried plants with water, because the extraction of the juices by mechanical means produces no change in their composition, and the extracts subsequently obtained by the inspissation of the juices are in composition and properties perfectly analogous to the latter.

Whether the same can be said of the extracts prepared with the solutions obtained by the action of water upon dried plants is a question which requires still considerable study before we can venture to pronounce a decided opinion upon it. This much is certain, however, that the desiccation of plants tends,

1. To dissipate part of the volatile principles; this, however, is of no consequence in the preparation of extracts, since the same effect is inevitably produced during the evaporation of the extractive liquors, no matter by which process they may have been obtained.

2. To coagulate part of the albumen. The liquor obtained by the action of cold water upon a dried plant never yields so copious a coagulum as that produced in the expressed juice, even after filtration of the latter.

3. To diminish the proportion of mucilage. This seems to me as yet rather doubtful, although it is generally supposed (and admitted by most pharmaciens) that dried mucilaginous plants yield with water a less mucous extract than may be obtained from the fresh plants. This is the

* Dr. Scoffern's Paper on Sugar next week.

* Drs. Muspratt and Hofmann.—"Phil. Mag.," vol. 27, No. 179, p. 182.

case, for instance, with Borrago and Viola arvensis.

4. To make the tannin and the extractive matter undergo the same kind of alteration which these prineiples suffer from contact with the air during the process of evaporation: the liquors obtained by the aetion of water upon the dried plants are, indeed, always of a darker colour than the expressed juices of the fresh plants. This speeies of alteration is particularly remarkable in Rhus radicans; the expressed juiee of this plant turns blaek upon exposure to the air, whereas the liquor obtained by the aetion of water upon its dried leaves undergoes no such change.

However, as I have already intimated, our knowledge of the ehanges which the divers parts of plants are liable to suffer during desieeation is very imperfect indeed; and, for the time being, we cannot venture to say, with any degree of certainty or preeision, whether or not extraets prepared with the liquors obtained by the action of water upon dried plants are greatly inferior in efficacy to those prepared by simple inspissation of the juiees expressed from the fresh plants.

This much is eertain, that in many instances the apothecary has no choice of proeess left to him, as the plants oecur in commerce in the dried state alone; and it is equally certain that, as regards a great many non-suceulent plants, the proeess of extraeting the juiee by the aetion of the press affords very little advantage.

Aqueous extracts are prepared with eold water, or by infusion or deeoetion. No matter to whieh of these methods the operator may choose to have recourse, he should always endeavour to obtain a most highly concentrated solution, in order to diminish as mueh as possible the liability of the latter to alteration during the subsequent process of evaporation.

When operating with cold water lixiviation is usually resorted to; there are, however, some substances which, from their mueous nature, or for some reasons conneeted with their texture, are treated more advantageously by maeeration. To this class belong, for instanee, squills, rhubarb, juniper berries, opium, aloës, cassia.

Matters containing prineiples readily soluble in water are usually treated with eold water, or, better still, with water of 68° Fahrenheit. The same process is resorted to in cases where it is wished to separate or to keep out of the extract some principle or matter which would dissolve in water of a higher temperature.

The solution obtained is heated and subsequently strained, in order to remove the albuminous coagalum whieh has formed. The strained liquid is then finally evaporated to the consistenee of an extraet. In this way (with water of 68° Fahrenheit) are prepared the extraets of—

Leaves of Wormwood,
" Aconite,
" Anemone,
" Mugwort,
" Borage,
" Bugloss,
" Germander (Chamaedrys),
" Centaurea benedicta,
" Hemloek,
" Belladonna,
" Digitalis,
" Hyoscyamus,
" Viola arvensis,
" Stramonium,
Flowers of Lesser centaury,
" Chamomile,
Roots of Quassia,
" Soapwort,
" Gentian,
Stalks of Duleamara,
Bark of the Willow,
" Oak,
" Root of the pomegranate-tree,
Cassia.

Borage, bugloss, and viola arvensis, which figure in this list, yield, after desiccation, a solution much less viscous than the juice of the fresh plants. As regards the acrid plants (belladonna, hemloek, digitalis, &c. &e.), these yield, when treated in this way, extraets free from albumen and chlorophyle; but it is a difficult question to decide whether the aqueous extracts differ in medicinal properties and efficaey from those prepared with the depurated juices of these plants. Indiscriminate and unauthorized substitution of the former for the latter would therefore be a very improper proceeding on the part of an apotheeary.

The following substances are treated with cold water for the purpose of excluding from the extract certain prineiples of whieh the presence may not be desirable, and whieh would dissolve in water of a higher temperature:—

The roots of Snakeweed,
" Dog's grass,
" Parsley,
" Liquorice,
" Ratanhia,
" Pareira brava,
" Bardana,
" Rhubarb,
" Rumex patientia,
" Elicampane,
" The grey cinchonia,
The leaves of Senna,
Juniper berries,
Agarieus albus,
Opium,
Liquorice juiee,
Aloës.

EXTRACTS PREPARED WITH ALCOHOL.

Aleoholic extracts are prepared in the following way:—

Reduce the substance which is to furnish the extraet to powder, and treat the latter with alcohol, either by the method of displacement, or by simple maceration or digestion, according to the nature and conditions of its texture. The process of digestion is preferred, for instance, for squills, saffron (both viscous substances), nux vomiea, seeds of hyoscyamus, belladonna, and stramonium. The process of lixiviation is conducted as follows:—Reduce the substance to powder, moisten the latter with one half its own weight of alcohol, put the mass into the lixiviation cylinder, and keep the latter closed till the following morning; commence now to lixiviate by adding two, three, or, to the utmost, four times the weight of the substanee of alcohol. When the aleohol has fully and thoroughly penetrated the powder displaee it by means of water, taking eare to draw off somewhat less liquid than the total quantity of alcohol used; if this precaution be neglected, the last products will be mixed with water. The proper moment to stop the operation is indieated usually by an appearance of turbidity in the alcoholie produet which up to that time had remained elear. Distil the product now in the water-bath to drive off the whole of the alcohol, and eomplete the evaporation finally in the usual way.

The use of alcohol affords always this advantage, that the proeess of evaporation is for the most part aehieved in a close vessel, and at a temperature below the boiling point of water, and that there remains only a small quantity of liquid for evaporation in the open air.

The treatment with alcohol is resorted to,

1. For certain matters of which the active parts are insoluble in water.

2. To effeet the solution both of principles soluble in water, and of principles soluble in aleohol.

3. To prevent the introduction of certain matters soluble in water, but insoluble in alcohol, and whieh it is wished to keep out of the extraet.

For substances containing both principles soluble in water, and principles soluble in alcohol, and which are equally intended to form part of the extract, weak alcohol (56 C., 21° Cartier) is used. Aleohol of this strength is particularly adapted for substances containing at the same time extractive matters, resinous principles, and essential oil. Such are, for instance, valerian, jalap, guaiacum, bark, snakeroot, rhubarb, rumex patientia, blaek helleborc. I must here observe, however, that these aleoholic extracts are usually more aetive than the aqueous extracts of the same substances, and that aecordingly, although the method of preparing these extracts with alcohol is unquestionably preferable to that of preparing them with water, yet the former should never be substituted for the latter by the apothecary, unless upon the express direction of the prescribing physieian.

The Pharmaceutical Codex of Franee directs the extraets of the following substances to be prepared with alcohol:—

Arnica montana,
Hops,
Bark of the box-tree,
Cinchonia bark,
Guaiaeum-wood,
Myrrh,
Roots of Black hellebore,
" Jalap,
" Sarsaparilla,
" Valerian,
Snakeroot.

The process of purification to which many of the gum resins arc occasionally subjected is closely allied to this method of preparing alcoholic extracts. The impure gum resins are pounded, and are subsequently acted upon with aleohol of 56 C. in the water-bath. The solution obtained is strained hot through a linen eloth; a fresh quantity of aleohol is then made to aet in the same way upon the non-dissolved remainder of the gum resin, and the solution strained hot like the first. The whole of the strained liquid is then evaporated to the original consistence of the dissolved gum resins.

Alcohol of 56 C. is resorted to also when the active prineiples of a substance (though equally soluble in alcohol and in water) are accompanied by a copious amount of inert matter equally soluble in water, but upon which alcohol fails to exercise any solvent aetion. Treatment with alcohol of 56 C. serves, in such cases, as a means to obtain the aetive prineiples of a plant in a smaller compass. It is for this reason that we prepare with alcohol the extracts of—

Cantharides,
Poppies,
Nux vomica,
Squills,
Saffron,
Seeds of Belladonna,
" Hyoscyamus,
" Stramonium.

The extracts of the following substances are also prepared with alcohol:—

Roots of Cainca,
" Colchieum,
" Columbo,
" Ipecacuanha,
" Polygala,
Bark of pomegranate-root,
Daffodil flowers,
Leaves of Digitalis,
" Aconite,
" Hemlock,
" Belladonna,
" Hyoseyamus,
" Stramonium.

With respect to this latter series of extracts, the reasons why alcohol should be used in preferenee to water are not clearly apparent. We may assume, however, that, as regards some of them (cainca, for instance, colchieum, columbo, daffodil), custom has a good deal to do with the use of the alcohol. Polygala-root is a viseous substanee, and the extraction of its active principles is accordingly more readily effected by alcohol than by water. As regards ipecacuanha, it is thought aleohol dissolves the emetie principle more perfectly than water. And, finally, with respect to the narcotico-acrid plants of the tribe of the Solaneæ, experienee has shown that these yield with alcohol active extracts of a fine green colour. The aleohol precipitates the albuminous, and undoubtedly also part of the extractive, matter; it dissolves the greater part of

the latter and of the gummous principles, and also the chlorophyle. The alcoholic extracts of these plants may, accordingly, be considered both superior and inferior to the aqueous extracts, superior from the absence of the albumen, inferior from the introduction of the chlorophyle. The decision of the question which is the most valuable extract of these plants, whether the alcoholic or the aqueous, or that prepared directly from the juice, rests more properly with the physician than with the apothecary. This much we know, that the alcoholic extracts of these plants are very active; and, as these plants yield generally less extract with alcohol than with water, it is probable that the alcoholic extracts contain the medicinal principle of the plants in a higher state of concentration than the aqueous extracts. I repeat here again, that, as the several extracts obtained by different processes from one and the same plant are not by any means identical, the apothecary should take care never to substitute one of them for another.

The following two methods appear rather advantageous for certain purposes which they are intended to accomplish, and may hereafter find more extensive application :—

1. The alcoholic extract is prepared in the usual way; it is then dissolved in a small quantity of water, the solution filtered, and finally evaporated again to the consistence of an extract.

The treatment with alcohol in the first instance serves here to separate all matters insoluble in that menstruum, whilst the subsequent treatment of the alcoholic extract with water serves to exclude from the extract all matters which are not equally soluble in alcohol and in water.

This process is resorted to for the preparation of the brown emetine, which is thus, in the first instance, freed from the gum and starch of the ipecacuanha, and subsequently (by the treatment with water) from the fatty matter.

2. The aqueous extract is prepared in the usual way; it is then dissolved in alcohol, the solution filtered, and the filtrate evaporated again to the consistence of an extract. The effect of this proceeding also is to leave in the extract none but principles equally soluble in alcohol and in water. M. Dublanc recommends this process for the preparation of extract of lettuce juice; M. Lombard for that of extract of aconite. MM. George and Hespe recommend it for the preparation of the (aqueous) extracts of hyoscyamus and the other plants of the tribe of the Solaneæ. M. Dublanc states that extract of lettuce juice prepared by this process is greatly superior in hypnotic property and action to the extract prepared in the common way.

EXTRACTS PREPARED WITH VINEGAR.

These extracts were formerly prepared with distilled vinegar. The only extract of this kind which is still sometimes used is Lalouette's acetous extract of opium.

M. Récamier has proposed the following method :—

Place the fresh plants on a perforated diaphragm (the perforated water-bath of an alembic will answer the purpose exceedingly well), and transmit through them the vapour of water acidified with vinegar until the odour of the plant is completely dissipated. Remove the thoroughly soaked plant now from the diaphragm, press strongly, and evaporate the whole of the liquid obtained in the process to the consistence of an extract.

M. Récamier prepares in this way the extracts of hemlock, belladonna, hyoscyamus, aconite, phellandrium, dulcamara, succory, &c. &c.

EXTRACTS PREPARED WITH WINE.

The vinous extract of opium is about the only extract of this class which is used in medicine.

Extracts prepared with wine contain, besides the principles of the plant, also the fixed principles of the wine.

Bacher's extract of black hellebore may also be considered to belong to the class of vinous extracts; it contains, however, besides the wine and the principles of the hellebore, also carbonate of potass.

EXTRACTIVE SYRUPS.

The different methods of preparing these syrups have been treated of already in a former lecture ("On Syrups").

SYRUPS PREPARED WITH THE JUICES OF FRUITS.

Under this head we have to mention only one syrup—that of buckthorn.

This is prepared by mixing the buckthorn juice with an equal weight of sugar, and boiling to the requisite degree of concentration.

SYRUPS PREPARED WITH THE JUICES OF PLANTS.

If the vegetable juice happens to contain some aromatic principles, the syrup must be prepared by simple solution in close vessels; the same process is resorted to also if the juices are sufficiently concentrated to produce the medicinal effect expected from their exhibition.

We prepare by simple solution the syrups of the juices of—

Borage,
Red cabbage,
Peach flowers,
Chervil,
Asparagus,
Cochlearia,
Cresses.

The proportions are 190 parts of sugar to 100 parts of juice.

SYRUPS PREPARED WITH EXTRACTS.

The extract is dissolved in the least possible proportion of water, the solution filtered, and the filtrate added to the syrup, which latter has previously been boiled beyond the proper degree of concentration. The mixture is then strained through a bolting-cloth.

In this way are prepared (with the extracts) the syrups of—

Belladonna,
Cachoe,
Cainca,
Emetine,
Ipecacuanha,
Hyoscyamus,
Poppy,
Opium,
Ratanhia,
Stramonium.

The syrup of sarsaparilla is prepared by solution of the sugar in the solution of the extract.

SYRUPS PREPARED WITH DECOCTIONS.

Decoctions charged with extractive matters are used for the preparation of syrups of which the medicinal basis contains some active principles that require for their solution the long-continued action of boiling water.

The only extractive syrup belonging to this section is that of Peruvian bark.

SYRUPS PREPARED WITH INFUSIONS.

The syrups of most flowers and herbs are prepared with infusions.

We prepare with the infusions of the fresh flowers the syrups of—

Camomile,
Carnation,
Narcissus Pseudo-narcissus.

With the infusion of the desiccated vegetalbe matters those of—

Wormwood,
Mugwort,
Maidenhair,
Digitalis,
Dulcamara,
Orange-peel,
Lemon-peel,
Gentian-root,
Ginger-root,

All these syrups are prepared best by simple solution.

The syrups of Rhubarb and of Rumex patientia are prepared with the solutions obtained by simple maceration of these substances.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

FURTHER RESEARCHES ON PROTEINE.

By Prof. G. J. MULDER.

The author commences by recapitulating some suggestions which he threw out last year on the probable arrangement of the elements in the proteine compounds. Sulphur and phosphorus he had intimated might be contained as an organic group in albumen, caseine, &c., in combination with proteine; in this view the author states he has been confirmed by the results of subsequent experiments. Protcine combines in various proportions with SNH_2 and PNH_2, and the products of this union are albumen, hair, &c. It combines also with oxygen to form another organic group, which likewise yields with SNH_2 and PNH_2 a class of bodies nearly allied to the above. Experiments establish the fact that sulphamide and phosphamide, when united with a single organic group, may form those substances which hitherto have been called albuminous bodies. Protcine—the organic group free from sulphur—must be regarded as merely an empirical expression. When an albuminous body is desulphurized, nitrogen and hydrogen are eliminated, and thus is explained the difference between proteine and the body to which that name was formerly applied. My earlier opinion certainly was that sulphur and phosphorus only were removed in the above-mentioned process. Therefore, to desulphurize albumen is to decompose the SNH_2 which is found in it. When this is effected the elements of water are presented; the $2(SNH_2+HO)$, $2NH_3$ escape, and produce S_2O_2, and the latter combines to a greater or less extent with the proteine. It is now evident that there can be no longer any question of the existence of a proteine free from sulphur, since the quantity of S_2O_2 existing combined with the proteine derived from various sources may be increased or diminished, and even reduced to a minimum quantity.

Desulphurization of Fibrine.—It may be regarded as an established fact that albuminous bodies when subjected to the influence of a hot solution of potash and exposed for some time to the air produce, on being mixed with acetic acid, a flocculent precipitate, which, when heated with potash upon silver, furnishes a stain of sulphuret of silver, and, when boiled with a concentrated solution of potash, does not exhibit the least coloration produced by the formation of sulphuret of lead on the addition of acetate of lead; but on the combustion of this precipitate with nitre it yields sulphuric acid, whose quantity varies with the different methods of preparing the substances, and with the different albuminous bodies.

I first endeavoured to fix the amount of sulphuric acid which is yielded by fibrine. With this view I mixed the substance in a silver crucible with pure caustic soda, moistened the whole with exactly as much water as was necessary to soften it, evaporated it at a gentle heat, and calcined it until no more hydrogen was given off. I then added nitrate of potash until the whole formed one clear liquor, allowed it to cool, and dissolved the mass in water acidulated with a few drops of hydrochloric acid. The sulphuric acid was then precipitated by chloride of barium, and the proportion of sulphur calculated from the sulphate of baryta. The proportion of sulphur obtained from fibrine was 1.2 per cent.

After fibrine had been heated with a solution of caustic potash until the solution afforded very marked reactions of sulphur with acetate of lead, and the liquid exposed for some days to the atmosphere until the reaction of sulphur had disappeared, one portion of the liquid was pre-

cipitated with acetic acid, another portion with oxalic acid, and a third with phosphoric acid. These precipitates gave no reaction on silver foil, but on combustion with soda and nitrate of potash they gave a quantity of sulphate of baryta. The sulphur of this salt corresponded in the mean to 0.72 per cent. Fibrine, it is thus seen, loses about one half its sulphur on treatment with potash, and contains the other half in some form incapable of acting on silver and lead.

Sulphurization of Fibrine.—To satisfy myself whether the organic group could be made to take up a larger proportion than 0.72 per cent. of sulphur, and also whether this amount might or might not be brought up to the amount primarily contained in fibrine (1.2 per cent.), I took a portion of the liquids of the experiment just described, from which a portion of the sulphur had been precipitated with acids, and poured sulphuric acid into it until all the organic matters capable of precipitation by this means were thrown down. The precipitate was washed and exhausted with alcohol. A second portion of fibrine was treated with a solution of potash in a similar manner, but in this case the sulphuric acid was poured immediately into the liquid, while it furnished a deep black colour with acetate of lead; this reaction was soon removed by the sulphuric acid. The precipitate thrown down by acetic acid was washed and treated as that before described.

By the first of these two methods the amount of sulphur is increased to 1.16 per cent., the quantity originally met with in the fibrine; by the second it is increased to 1.49, or nearly the same quantity contained in albumen. As the augmentation from 0.72 to 1.49 per cent. arose under circumstances which give rise to S_2O_2 (the liquid contains KS; therefore, when SO_2 passes through it, $2KS + 4SO_2 = 2KO + 3S_2O_2$ is formed), this increase must be owing to hyposulphurous acid. Further, bearing in mind that the above-mentioned liquids originally included KS, which must have become converted by the oxygen of the air into KOS_2O_2, we must refer to this source not only the increase of the amount of sulphur to 1.49 per cent., but also the 0.72 per cent. occurring in the precipitate. The form in which the sulphur is originally contained in fibrine, and that which has arisen under the treatment with potash, have nothing in common: the former forms sulphurets with silver and lead, but the latter has none of these properties.

Desulphurization of Albumen.—It was very important for the purposes of this inquiry to determine with accuracy whether in treating albumen with potash the quantity of sulphur contained in the organic group after precipitation with acetic acid, in some form in which it will not act on silver and lead, would answer to the original quantity, or would amount to more or less. On a former occasion I had found 1.38, 1.13, 1.38 per cent. of sulphur in 100 parts of albumen derived from an albuminate of copper. I was able to obtain 1.67 per cent. of sulphur by fusion with soda and nitrate of potash; but further experiments have shown that proteine from albumen only contains 1.6 per cent. of sulphur when prepared with potash.

I dissolved albumen in a solution of caustic potash in the manner above described, and added at the same time a small quantity of phosphorus, so that a small portion of phosphorus was always undissolved: when the liquid had stood in the water-bath for four hours, and had been frequently shaken, it was filtered while hot, and precipitated with acetic acid. The same amount of sulphur was yielded by the precipitate as the proteine which had not been treated with phosphorus.

When to a similar solution of albumen in potash an excess of protochloride of iron was added, and afterwards a solution of potash to precipitate the whole of the iron, a considerable amount of sulphuret of iron was at once formed: the precipitate which acetic acid produced in the filtered liquid exhibited upon silver foil the reaction of sulphur, and contained 1.37 per cent.

Another solution of albumen in potash was agitated with an excess of minium, the resulting sulphuret of lead was separated from the liquid, which was freed from any sulphuret of lead in solution by addition of acetic acid and repeated filtration. With acetic acid it now furnished a precipitate destitute of any reaction upon silver, and containing 1.48 of sulphur.

Albumen was treated in the same manner with brown peroxide of lead, and furnished a precipitate which contained 1.29 per cent. of sulphur.

From these experiments it is clear that proteine derived from albumen possesses the same amount of sulphur = 1.6 per cent. only after treatment with potash, but this in such a form that its presence cannot be determined with silver or lead. This proportion is not altered by deoxidizing substances, like phosphorus; but it is diminished by those substances which readily yield their oxygen.

Sulphurization of Albumen.—I subjected albumen to the same treatment as that described for the sulphurization of fibrine. The precipitate contained 1.55 of sulphur, *i.e.*, the same quantity as would have been obtained without the use of sulphurous acid. The amount of sulphur in the albuminous precipitate is not increased by SO_2 (acting upon KS, and producing S_2O_2). I dissolved the white of ten eggs in caustic potash with one gramme of flowers of sulphur, and digested the whole in the water-bath, and exposed it to the action of the air for four weeks, by which time all reaction upon lead salts had vanished. The precipitate thrown down by acetic acid contained 1.811 per cent. of sulphur. Albumen, to which two grammes of sulphur had been added, treated in the same manner as the foregoing, yielded a precipitate which contained 2.00 per cent. of sulphur. Two grammes of proteine, from albumen which had furnished 1.57 per cent. of sulphur, were dissolved in a dilute solution of caustic soda. This solution was mixed with O 5NaO, S_2O_2, and precipitated with acetic acid: it contained 1.77 per cent. of sulphur.

It is difficult to say in what form the sulphur is contained in albumen: most likely it is held in solution as such in the acetic acid in the proteine. Perhaps it was thus that the quantity of sulphur having no reaction upon lead and silver could not be increased above 1.6 per cent. But can the amount of sulphur diminished to 1.29 be again increased to 1.6 per cent.? If so, it probably can only be under circumstances under which only S_2O_2 can be found. The answer to the above question would throw some considerable light on the sulphur compounds; but this answer could only be obtained by procuring albuminous protcine containing 1.29 sulphur incapable of reacting on silver, dissolving this in potash, and precipitating it with acetic acid, or dissolving this proteine at a common temperature and adding some hyposulphite of soda. Upon a review of the experiments I am inclined to think that all the sulphur existing in proteine which refuses to act upon silver exists in the state of S_2O_2. If, now, we regard the amount of sulphur existing in albuminous protcine as a variable quantity, we must also admit that in the preparation of proteine some sulphur compound must have been eliminated and another one taken up. We have found that the sulphur compound last added is an oxide of sulphur, and most likely S_2O_2. As the quantity of sulphur found in albuminous proteine varies between 1.6 and 1.3, in the latter case some body must have mixed with it which contains no S_2O_2, or an inappreciable quantity. As we proceed we shall become acquainted with several similar circumstances. Calculating the amount of this acid from the sulphur found in albuminous proteine as S_2O_2, we have in 100 parts:—

Maximum.	Minimum.
$S_2O_2 = 2.40$.	1.95.

Chlorite of proteine well prepared contains sulphur which does not act on the salts of silver or lead; but a combination of ClO_3 with albumen indicates that reaction very distinctly. Chlorite of proteine contains 76.5 per cent. proteine, which, on combustion with soda and nitrate of potash, yields 1.22 per cent. sulphur. Chlorine converts all albumen into chloro-proteine; it thus offers a means of desulphurizing proteine, and is, moreover, well adapted to determine with accuracy the forms in which sulphur occurs in albumen. Chlorine receives no sulphur from albumen; it merely is changed into the form S_2O_2.

Dephosphorization of Albumen and Fibrine.—Phosphorus occurring in combination with albumen and fibrine can always be easily removed by solution in hot caustic potash and precipitation by acetic acid. The precipitate will contain no trace of phosphorus, nor can it combine with phosphorus, as one of the foregoing experiments has shown.

Composition of Albuminous Proteine.—The composition of the precipitate from albumen, which we obtain when the latter is dissolved in a hot solution of potash, and the solution is exposed to the air until it ceases to give sulphuric reactions, and then precipitated with acetic acid, cannot be ascertained but by bringing the sulphur which occurs in it into calculation, or by having regard to the form in which the sulphur is contained in it. The form is S_2O_2, but the quantity, as we have seen, is variable. Unless the last trace of albumen has been decomposed, and the whole of the proteine combined with S_2O_2, the N cannot be correct, since SNH_2 are eliminated in the formation of proteine. Proteine from albumen giving 1.4 per cent. of sulphur as S_2O_2 only gives 14.4 per cent. as N. The nitrogen of proteine is thus too high in my experiments, and is also too high in those of Scheerer, Dumas, and Cahours.

Albuminous proteine not acting upon silver leaves an unweighable quantity of incombustible residue, and in different experiments it gave 14.12 and 14.23 per cent. Volcker found 14.0 to 14.4. The proteine from albumen which shows no reaction upon silver, and contains S_2O_2 in greatest quantity, is formed of C 53.7, H 7.0, N 14.2, O_2 3.5, S 1.6.

Reduce these numbers by S_2O_2,—in other words, calculate the sulphur by S_2O_2 and deduct it,—and the following are the proportions of one 100 parts:—

			Reduced by S_2O_2.
Carbon	53.7	53.7	55.0
Hydrogen..	7.0	7.0	7.2
Nitrogen ..	14.2	14.2	14.5
Oxygen ..	23.5	22.7	23.3
Sulphur ..	1.6	—	—
	100.0	97.6	100.0

The above statement is, in my opinion, the true formula of a proteine perfectly free from sulphur. It will be seen that it differs from the former, as it contains 1.5 per cent. less N. In my earlier experiments this error was not detected, because I took all the combinations of albumen, with tannic acid, sulphuric acid, and chlorous acid, to be proteine compounds. They are not so: they are combinations of albumen, and, therefore, of protcine with SNH_2.

Composition of Albumen.—The composition of albumen and of albuminous proteine with S_2O_2 is exhibited in the following table:—

	Albumen.	Proteine from albumen with S_2O_2.
Carbon	53.5	53.7
Hydrogen	7.0	7.0
Nitrogen	15.5	14.2
Oxygen	22.0	23.5
Phosphorus	0.4	—
Sulphur	1.6	1.6

Comparing these numbers, we find that C and H remain in their original condition, N has increased in the albumen, and O has become less; phosphorus is eliminated, and the sulphur has entered into a different combination, as the albumen is converted into protcine. It seems that S_5NH_2 and PNH_3 separate, their place being occupied by S_2O_2. When we reduce albumen by the first two substances we get the same organic group which presents itself when

proteine from albumen with $S_2 O_2$ is reduced by $S_2 O_2$.

	Albumen of egg reduced by NH_2 and PNH_2.			Proteine from albumen reduced by $S_2 O_2$.
Carbon....	53.5	53.5	55.6	55.
Hydrogen..	7.0	6.8	7.1	7.2
Nitrogen ..	15.5	13.9	14.4	14.5
Oxygen ..	22.0	22.0	22.9	23.3
Phosphorus	0.4	—	—	—
Sulphur ..	1.6	—	—	—

[*To be continued.*]

DESCRIPTION OF A NEW INSTRUMENT FOR DETERMINING THE RELATIVE QUANTITIES OF TWO LIQUIDS WHEN MIXED TOGETHER; MORE PARTICULARLY MIXTURES OF ALCOHOL AND WATER.

By J. T. SILBERMAN.

Numerous means have been devised and employed for the purpose of ascertaining the relative quantities of alcohol and water in their admixtures, to each of which some weighty objection may be urged. The method which I have the honour to lay before the Academy is, I believe, a new one, and is not liable to any of the objections to which the plans now in existence are open.

In constructing the processes hitherto in vogue, the distillation, boiling point, or density of the alcoholic mixture has been taken as a criterion. My method is based upon the dilatation of the liquid. Between Zero and 100° Cent. of temperature the dilatation of alcohol is, it is well known, three times that of water. But this dilatation is much greater, between 25° and 50°, and may be thus shown :—Let water at 25° be poured into a thermometer, so as to fill the reservoir, and also a small portion of the tube up to a point marked on the tube. On heating the thermometer to 50° the water will rise to a certain height above the mark ; let this point be also marked on the tube. Now let the same quantity of pure alcohol at the first temperature (25°) be placed in the thermometer, previously emptied of the water, and heated to 50°. The alcohol will be found to have risen higher than the water 3½ times. A mixture of alcohol and water on being treated in this way will be found to have a point of dilatation which is a mean between these two, approaching either as the one or the other liquid prevails. Thus, if a series of mixtures of alcohol and water be prepared, commencing with water 100 parts, alcohol 0 ; water 99, alcohol 1 ; water 98, alcohol 2, and so on, up to water 0, alcohol 100, and the highest point of each, at the temperatures 25° and 50° respectively, be marked on the tube, we shall have a complete alcohometrical scale indicating the proportion of alcohol contained in any admixture of alcohol and water, by the use of the temperatures 25° and 50°.

Any other two liquids whose points of dilatation differ from those of alcohol and water may be thus treated, but each mixture must have its appropriate and exclusive scale. In order to make this instrument more generally useful in the measurement of alcoholic quantities, I have constructed a peculiar thermometer, which I call a dilatometer. The following is a description of its structure and arrangement :—Two thermometers are fixed to a plate of metal ; the first of these is of mercury, marked with the extreme temperatures (25° and 50°, for example), and the other, holding the liquid to be tested, is open at the top and bottom ; at its lower end it is tapered like a funnel, and it terminates above in a large tube.

The alcohometric scale being above the point where water ceased to expand at 50°, that portion intended for the dilatation of clear water may be replaced by a space of equal contents, shorter, but wider, the tube being enlarged in the interior. By thus shortening the tube a space is gained for increasing the number of its divisions. The tapered point of the second thermometer which holds the liquid is closed below by a small cork properly fixed on a spring fastened to the supporting plate.

In order to cause the liquid under examination to flow, this spring-valve is depressed by the agency of a copper rod, which is held on to the supporting plate by a clamp piece so as to act on the spring, and fastened to the top or funnel-shaped part of the thermometer by a nut which is adapted to the upper part of the rod. To get a quick motion the spring is furnished with four threads, and the thermometer is opened or shut by turning the head of this rod in one or the other direction. The liquids being frequently charged with air or gas, it is advisable to drive these off; this is best effected by producing a vacuum in the tube of the thermometer by means of a small piston which works in it. The piston first serves, by suction, to fill the thermometer below, and afterwards, when the lower part is closed, and the piston driven down ; on elevating it the air leaves the water or other liquid from all points. A very few strokes of the piston suffice to purify the liquid, and no more bubbles will rise throughout the operation. The piston-rod is made hollow throughout, to avoid all shock, which would divide the column suddenly when the piston is withdrawn. The operator, first wetting his finger, applies it to the top of the piston-rod, so as to create a vacuum as he draws the piston up ; he then opens the aperture by removing his finger, and readmits the air : thus the piston is removed without any shock. The vacuum will not be properly formed, unless the liquid is pumped in, until it rises through the piston-rod when the piston is depressed ; the operator, seeing this take place as he raises the piston, is assured that the air remains beneath it. The tube being now full of liquid, the liquid is let off by removing the spring-valve, until it is only as high as the lowest mark on the tube, after the temperature has stood for two or three minutes at the lowest degree of the mercury thermometer.

The inconveniences I mentioned at the commencement of this paper are of the following kind :—

Distillation.—This is a very long operation, and demands great skill : it is now very rarely employed. It originated with M. Gay-Lussac, who was rather anxious by means of it to establish a doctrine than to initiate a practical process.

Density.—The errors in this process arise from mixing the liquid with salts or syrups whose specific gravity, being greater than that of alcohol, prevents its true quality from appearing : in this way the exeise duties are evaded, and the purchaser is rendered more liable to be cheated. For this reason wines only indicate one half their real strength. M. Gay-Lussac in such cases employs his alcoholic areometer in combination with his distilling process.

The Boiling Point.—The best process on this principle is doubtless that of M. Tabarié ; but practical persons are well aware of the difficulties which are met with in determining this point ; they know that steam or vapour may be treated above the point at which they are generated, and that the thermometer, even when immersed in the liquid under particular circumstances, stands some degrees below the actual temperature, which, for every extra degree of temperature, would give an error of four alcohometric degrees. It is, moreover, necessary to take the barometric variations into the calculation more precisely than has yet been done.

My process may be applied to test wines as well as alcoholic liquors of any strength, since the salts and vegetable substances which enter into their composition in combination with alcohol and water do not affect the result, for all solutions expand in the same degree as water within the range of temperature I have named. Liquids more dilatable than alcohol need not be expected to be met with, as they are more expensive, and may also be detected by their characteristic smell or taste. I have taken 25° as the lowest temperature because even in summer water may always be found below that point. As to the final temperature of 50°, it has been chosen to avoid the effect of evaporation, which might diminish the actual degree if it approached too near the boiling point. The two temperatures offer great facilities for the experiment, as, if it be conducted in a vessel of the capacity of one quart, a small spirit-lamp placed beneath will suffice to maintain either of the two temperatures. The plate which carries the two thermometers contributes to agitate the water, and so to keep its temperature equal throughout.—*Comptes Rendus*, Oct. 23, 1848.

FOREIGN SCIENTIFIC INTELLIGENCE.

RESEARCHES OF M. BOUSSINGAULT ON THE INFLUENCE OF CERTAIN ALIMENTARY SUBSTANCES ON THE PROPORTION OF FATTY PRINCIPLES IN THE BLOOD.

Several experiments have demonstrated the fact that, under certain circumstances, the serum of the blood is capable of assuming a lacteseent appearance, produced by globules of fat which are found suspended in it ; and such milky serum has been found to contain from 12 to 100 parts of fatty substance. It has, also, been asserted by many physiologists that it is possible to produce this milky quality of the blood by feeding animals on grease or fat. The same phenomenon, it was at last said, was observable in individuals who were subject for a sufficient time to an abundant regime producing fatness. M. Boussingault is far from absolutely contesting these assertions, but, as his experiments on digestion had given him an opportunity to observe in what proportion the fat contained in articles of food was absorbed by the intestinal apparatus, he could not help throwing some doubt on these assertions. His researches, however, had the sole object of examining whether during the process of digestion of articles abounding in fat the blood became *decidedly* more fat than when the animal had lived on things that contained no fat whatever.

Messrs. Sandras and Bouchardat have already established in their work on digestion the fact that the nature of alimentary substances does not exercise any decided influence on the quantity of fatty principles in the blood. The articles of food, therefore, may be oil of almonds, suet, or lard, or may consist of bread, panada, and bouillon, skimmed of its fat. The blood of dogs which have been submitted to these different regimes will invariably contain a two or three thousandth part of fatty substance. Messrs. Sandras and Bouchardat think that this small proportion of fat in the blood of dogs even fed on soup must be ascribed to the bread and bouillon, being hardly exempt from a certain quantity of fatty substances. These results are, by M. Boussingault's researches, confirmed to this extent, that the blood of birds which he submitted to experiments contained but a very minute amount of fat, that is about $\frac{1}{4000}$th or $\frac{1}{5000}$th part. He also confirmed the fact that the blood of animals fed on articles containing no fatty principles at all still contained as much fat as the blood of those animals that had been allowed to consume food abounding with fat ; but M. Bouchardat does not ascribe the origin of this fat in the blood to the small amount of oleaginous matters pre-existing in the food, as he obtained the same results although he had made his animals consume only the white of eggs and starch, substances almost entirely free from fatty principles. Moreover, the blood of animals which for several days had been deprived of food altogether still was found to contain as much fat as the blood of an animal that had been fed on lard or nuts. His mode of procedure was as follows :—

The animals to be operated upon did not receive any food for thirty-six hours ; one out of

every lot was killed fasting, the others were fed on various articles for a certain time. The blood received in a capsule was weighed and dried and afterwards reduced to powder, in order to submit it again to a prolonged exsiccation at a temperature of 120° to 130°. The blood was only considered to be in a dry state when its weight after an hour of exsiccation only amounted to a few milligrammes. Out of curiosity he in several cases continued this process of exsiccation for many days, and there constantly resulted a loss of blood, a fact which M. Bouchardat considers is owing to a slow combustion experienced by organic matters whenever they are exposed to so high a temperature. The exsiccated blood was then repeatedly treated with ether, and the fatty substance left by the latter was washed in water before weighing. This substance always afforded a yellow fat of the consistency of honey, and of disagreeable characteristic smell. The fatty substance of the blood appeared to be identical with that taken from the chyme.

The following is a tabular result of M. Boussingault's researches :—

—	Quantity of blood operated upon.	Blood obtained in a dry state.	Dried matter to 1 of blood.	Fat obtained.	Proportion of fat in normal blood.	Kind of food consumed.
	gr.	gr.		gr.		
1st Series.						
Pigeons of three weeks.....	17.30	2.86	0.1893	0.036	0.0021	Starch.
	17.34	3.27	0.1946	0.097	0.0056	White of eggs.
	14.95	2.86	0.1913	0.065	0.0043	None.
2d Series.						
Pigeons of one month	14.315	2.58	0.1800	0.071	0.0046	Starch.
	15.40	2.99	0.1942	0.085	0.0055	White of eggs.
	14.435	2.83	0.1961	0.094	0.0065	Lard.
	13.94	3.03	0.2174	0.044	0.0036	None.
	13.325	2.52	0.1906	0.094	0.0070	None.
3d Series.						
Canary birds.....	84.71	7.50	0.1540	0.204	0.0042	Starch.
	34.26	6.27	0.1825	0.152	0.0044	White of egg jelly.
	37.55	8.105	0.2158	0.277	0.0049	Nuts.
	33.57	6.02	0.1793	0.114	0.0034	None.

Annales de Chimie et de Physique (Dec., 1848).

ON THE PRESENCE OF SALICINE AND CARBOLIC ACID IN CASTOREUM.

By F. WOHLER.

It was announced some time ago that the odour of fresh castoreum was probably due to the presence of a small quantity of carbolic acid, and the supposition has been confirmed by subsequent experiment. As it is now well ascertained that carbolic acid is a very poisonous substance, this circumstance demands further notice. On the occasion which has suggested this paper another substance was found in castoreum, viz., salicine. The presence of this substance, and also that of benzoic acid, may throw some light on the physiological significance of this organ, seeing that these substances must certainly be derived from the beaver's food.

The sac of castoreum canadense which I used was certainly genuine and intact. The mass which it contained was of a light yellowish-brown colour, soft, homogeneous, and very odorous. It was opened with a knife, and distilled with water. The distillate was clear, containing only a few drops of oil, and smelling strongly of castoreum. It gave a very distinct though faint reaction characteristic of carbolic acid when treated with perchloride of iron: it became violet, but this colour shortly disappeared with a whitish cloudiness exactly like carbolic acid. It was not coloured yellow by ammonia like salicylous acid.

The liquor remaining in the retort was next filtered boiling hot from the mass of castoreum. It became turbid on cooling, and a small quantity of a yellowish powder was deposited, the nature of which I was unable to ascertain. It dissolved readily in potash. It contained no uric acid. The colour with which it dissolved renders it probable that it was ellagic acid. It became turbid on mixing with hydrochloric acid, and deposited during the day a considerable quantity of small crystals in groups, which after washing and recrystallization exhibited all the properties of benzoic acid. But it is here to be noticed that the mother liquor, separated from those crystals, gave at first, with perchloride of iron, a deep blue-violet colour, and afterwards the white cloudiness peculiar to benzoate of iron, a reaction indicating, or at least suggesting, the presence of salicylous acid. Salicine does not furnish this colour. After many experiments I have satisfied myself that the benzoic acid was neither cinnamic nor hippuric acid, nor could it have originated from the latter by decomposition.

The salicine was found in the muriatic solution after the benzoic acid had separated. The muriatic acid was saturated with carbonate of baryta, the solution evaporated to dryness, and the dried mass extracted with alcohol. This left a smeary semi-crystalline mass on evaporation, which on being distilled with chromate of potash and dilute sulphuric acid gave an aqueous solution of salicylous acid, well marked by odour, the yellow colour produced on saturating with alkalis, and the dark violet colour on being mixed with perchloride of iron. The soft, resinous residue, on distillation with chromate of potash and sulphuric acid, yielded a weak solution of salicylous acid.—*Liebig's Annalen*, vol. lxvii., p. 360.

Charcoal a Disinfectant.—"It should be known," says a recent correspondent in the *Times*, "for the healthiness of unions having large cesspools, that a very simple method may be adopted to disinfect the mass of filth accumulated in their sewers, viz., the admixture of charcoal. The charcoal made from peat can be furnished most economically for the purpose. Moreover, such mixture of peat charcoal with the foul matter not only disinfects and deodorizes it, but forms a most valuable manure, far preferable to and less expensive than guano. If you give publicity to this statement you will be apprising the public how they not only may provide against the infection that threatens to arise from their drains, but may turn to pecuniary advantage what otherwise might be so prejudicial." It is to be hoped that such a plan of deodorizing or disinfecting will be never relied upon. Even charcoal in its most porous form would be most inefficient under the circumstances, and peat charcoal is one of the most inadequate kinds of the material.

Scarlet Dye.—Take bitartrate of potash 1¾ ounce, water a sufficient quantity, boil in a tin vessel, and, as soon as solution is complete, add of a solution of tin, made by dissolving 2 ounces of grain tin in a mixture of 1 pound of nitric acid and water, and 1½ ounce of muriate of ammonia, boil for three minutes, then introduce the cloth, and boil. Drain and cool.

REVIEWS.

MOHR AND REDWOOD'S PRACTICAL PHARMACY.*

Whilst the chamber chemist and chemical manufacturer have been aided in their manipulatory operations by the masterly treatises of Faraday, Rose, and Fresenius, the dispensing chemist, or pharmaceutist, has had no other guide but that of his own information, solely acquired, perhaps, during an apprenticeship, or else a little aided by some few casual observations made in some unusually well-directed pharmaceutical laboratory. As for treatises on special pharmaceutical manipulation, there were none, at least not in English, which is equivalent for a large section of pharmaceutical students to—none absolutely.

Mr. Redwood, by offering the British pharmaceutists a translation of the work of Dr. Möhr, has done a great deal in the direction of providing his numerous class with a treatise of reference to aid them in their pursuits,—a book which will stand in the same relation to the pharmaceutist that Faraday's treatise on manipulation does to the general chemist.

The author in his preface explains that he has not aimed so much at a translation as an adaptation of Dr. Möhr's treatise, and that he has added a considerable amount of original matter. In respect to the adaptation he is right; and Mr. Redwood's own additions are, with one or two exceptions, worthy of their German associate. A literally translated book on German pharmacy would necessarily contain many portions useless to the English chemist and druggist. Not only are many, nay most, of the galenical preparations different from those of the English Pharmacopœia, but there is a certain difference of social status and social requirements between the English and the Teutonic race which would render a treatise on practical pharmacy written for the one of not much utility (if literally translated) for the other. Take, for instance, a German notion of the proper entrance to a druggist's shop :—

"The entrance to the shop ought not to be directly from the street, but from the passage to the house. There are several objections to having the entrance directly from the street: it occasions the admission of wind, dust, and wet, when the door is opened, and renders it difficult to regulate the temperature of the room, and ensure the comfort and freedom from unnecessary disturbance of those engaged in conducting the business."

This arrangement may do very well for a German town or village where there is a paucity of druggists' shops. In this country, however, the requisites of a shop are differently appreciated. Thus Mr. Redwood, in commenting on the passage, forthwith says :—

"In free-trade England, however, it is generally considered desirable to make the access to the shop as easy and obvious as possible. I have heard calculations made, by some approved economists, to show the loss a tradesman sustains in consequence of his shop-floor being elevated too much above the level of the street, thus rendering it necessary for customers to ascend two or three steps on entering. One step, if it be a low and easy one, is considered beneficial, the advantage resulting from the exclusion of wet and dirt being more than equivalent to the obstruction it imposes on the facility of admission; but every step beyond this is calculated to involve a loss to the owner of the shop. A good economist will also be careful to provide easy means for opening and shutting the shop-door: an imperfect latch or inconvenient handle to the

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* Practical Pharmacy: the Arrangements, Apparatus, and Manipulations, of the Pharmaceutical Shop and Laboratory. By Francis Möhr, Ph. D., Assessor Pharmaciæ of the Royal Prussian College of Medicine, Coblentz; and Theophilus Redwood, Professor of Chemistry and Pharmacy to the Pharmaceutical Society of Great Britain. Taylor, Walton, and Maberly.

door, by occasioning annoyance to the customer, becomes a source of injury to the tradesman."

The author, or rather authors, then go on to describe, aided by a profusion of illustrations, the most convenient sources for the application of heat extemporaneously for pharmaceutical operations, the best mode of ventilation, and other subsidiary matters.

A description of the laboratory next follows, and afterwards the storeroom and drying-loft;—matters all of great importance, and much better cared for in Germany than here.

Next follows a description of the Beindorf steam apparatus, which we do not consider to be so good as many in general use here, on account of the necessity of operating with steam of a very low temperature. The process of distillation which is now discussed contains much valuable information on this all-important subject, and cannot fail to be eminently useful, being as far removed from the refinements of analytical chemistry on the one hand as it is from the roughness of the large manufacturing operations on the other.

The operations of infusion, digestion, and evaporation contain a great many important observations, even for the experienced pharmaceutical operator; and under the latter head is a popular explanation of the nature and operation of the vacuum-pan.

The remarks upon presses are, perhaps, rather more diffuse than the subject required, inasmuch as English pharmaceutists are usually well supplied and well acquainted with the nature and properties of this important mechanical aid.

The chapter on filtration is good, although it participates in a common mistake of most chemical treatises in representing the sugar-refiner's bag-filter as very different from the truth.

The article on drug-grinding, by Mr. Redwood, embodies a great deal of most useful information on the changes effected upon the chemical composition and properties of certain bodies after having been exposed to this treatment; it also throws much light upon the long-mooted but undecided question whether the four-per-cent. system be fair or not. A portion of this chapter, however, we will transcribe for the reader's satisfaction and instruction:—

"The first operation connected with the grinding of drugs consists in drying them. If they are in large masses, these are cut or broken into small pieces to facilitate the drying process, and also to prepare them for being put under the stones when dry enough to be powdered. The drying is generally effected in a room heated to about 120°, by means of a stove or steam-pipe. The most common method of heating the drying-room appears to be by the use of a cockle, that is, a stove having an outer case or jacket, between which and the fire-case there is a space for the circulation of air. A great many different forms are given to the cockle, which is sometimes made of iron, and sometimes of brick, but it should always be so placed that the fire can be fed from the outside of the room, so that the atmosphere of the room may not be contaminated with smoke or dust.

"The drying process being completed, the substance is placed on the platform of the mill, in the path of the stones, where it is ground until sufficiently comminuted for the commencement of the next operation, namely, that of sifting it. The two operations of grinding and sifting are then continued simultaneously, the operator transferring a portion of the powder from the mill to one of the drum-sieves, which latter, with its contents, is put into its appropriate receptacle in the frame of the sifting apparatus, where it is subjected to the requisite succussion. The residue, which does not pass through the sieve, is returned to the mill, and a fresh portion of powder taken out to be sifted; and this mode of proceeding is continued without suspending the motion of any part of the machinery, until the process is finished.

"In using the stampers it is necessary to suspend the pounding or stamping while the substance under operation is being removed from, and introduced into, the mortar, which somewhat retards the process.

"The facility with which drugs are reduced to powder by the means which have been described depends in great measure upon the extent to which they are previously dried. If they be not deprived of their hygrometric water to the greatest extent practicable by exposure in the drying-room, it will be difficult, if not impossible, to produce perfectly smooth and impalpable powders, such as are now generally used in medicine. This drying is, of course, accompanied by a loss of weight, arising from the water which is driven off, and which varies considerably in different drugs, and also in different specimens of the same kind of drug. There is always, however, a little moisture again absorbed during the process of grinding. In some cases this reabsorption takes place to a considerable extent, so that it may be necessary to renew the drying before the process is concluded, if the atmosphere of the room be at all damp. This is the case with squills, jalap, rhubarb, aloes, and colocynth.

"There are some drugs which, however carefully they may be dried, are, nevertheless, with great difficulty reduced to powder by the ordinary method of proceeding. Nux vomica, St. Ignatius' beans, and the tuberous roots of the orchis, belong to this class. They are tough and horny, and can hardly be powdered without a particular treatment. The best method of preparing nux vomica and St. Ignatius' beans for pulverization is, to expose the seeds to the action of steam until they have swelled to about twice their original size, and then to dry them rapidly in the drying-room. The roots of the orchis, which are ground to make saloop powder, should be macerated in cold water until they have become soft, and then dried as in the other case. After being thus treated they are easily powdered.

"Some substances cannot be powdered alone; they require the addition of other bodies which facilitate the disintegration. Thus the addition of a few drops of spirits renders the pulverization of camphor easy, although it could not be effected without it. The process, when thus conducted, is sometimes called pulverization by mediation.

"It is a common practice with drug-grinders to add a small quantity of olive oil or oil of almonds to some drugs during the process of grinding. This is found to facilitate the comminution, and greatly to improve the appearance of the powder.

"Agaric is a substance which it is extremely difficult to powder alone, and a method has therefore been proposed for powdering it by mediation. It is cut into small pieces, wetted with mucilage of tragacanth, and then dried, previously to submitting it to the process of grinding. The addition of a foreign body, which the powder retains, cannot, however, be sanctioned, excepting under particular circumstances, such as the impossibility of otherwise effecting the object. It is stated in some pharmaceutical works that colocynth is powdered by mediation, in the same way as that above described for the pulverization of agaric; but in this case the addition of a foreign body is certainly unnecessary, and I believe that no such addition is made by the drug-grinders in this country.

"Phosphorus is powdered by mediation, and this, indeed, is the only way in which it can be obtained in a state of minute division. The best mediatory substance to use is a spirit. The phosphorus being put into a bottle with some spirit, a gentle heat is applied, by plunging the bottle into warm water until the phosphorus melts; the mouth of the bottle is then closed and brisk agitation continued until it has cooled, when the phosphorus will be found to be in a finely-divided state. Water might be substituted for spirit, but does not answer so well.

"A method of a somewhat analogous nature to that last described is adopted for powdering some salts which are not easily reduced to powder by trituration. The salts are dissolved in water, and the solution evaporated to dryness whilst constant and active agitation is maintained. This is a very convenient and economical method of obtaining sal-ammoniac in powder. It is also adopted for granulating salt of tartar, and tartrate of potash.

"Substances the particles of which readily adhere when submitted to pressure, but which, nevertheless, are not held together by a strong cohesive force, are sometimes powdered by friction over a perforated surface. Thus magnesia and other similar substances are merely rubbed over the surface of a sieve.

"Such are the various methods adopted in effecting the pulverization of drugs, and which are applied, according to the requirements of the several cases, to most kinds of solid substances employed in medicine—to some, in order to make them more suitable for administration—to others, in order to fit them for subsequent operations. It is, therefore, an interesting and important subject of inquiry, in connection with a process of such general use in the preparation of medicines, how far is it practicable to preserve the chemical condition of the substances operated upon unaltered, and their medicinal efficacy unimpaired?

"The operations connected with the processes of drug-grinding do not seem to be calculated to promote chemical change in the constituents of the powder; for, although the disintegration, by exposing a larger surface to the action of the air, may be somewhat unfavourable to the permanence of the proximate constituents of vegetable substances, yet the complete desiccation which forms part of the process will exercise a conservative influence to probably an equal extent. This, at least, would be the case if the powder, when prepared, be put into close bottles and kept for only a moderate length of time.

"The principal, if not the only necessary, cause of deterioration to the product in the process of drug-grinding is the long-continued application of heat to which the drugs are exposed in the drying-room. There are many substances which cannot be thus dried without having a portion of their active volatile ingredients driven off, as well as the water they contained. The strong smell which fills the drying-room when opium, or myrrh, or cinnamon, are under operation, affords sufficient evidence that some volatile matter besides water is escaping, and that the resulting powders cannot strictly represent the drugs from which they are made. All substances which contain volatile principles must lose a portion of these during the drying process which precedes and sometimes accompanies that of pulverization; and if the efficacy of the medicine depend upon these volatile parts, the product must be injured by the process to which it is submitted. Thus, myrrh, valerian, cardamoms, cinnamon, and spices generally, lose some of their efficacy in being reduced to fine powder.

"But a large proportion of our drugs are not subject to deterioration from loss of volatile constituents; and in these cases, if care be exercised in conducting the process of drying, the powders obtained by the usual method of operating will possess all the medicinal properties of the crude materials. Thus, rhubarb, jalap, ipecacuanha, colocynth, scammony, gamboge, and many other drugs, are not necessarily injured in the process of powdering.

"There are some drugs which not only suffer no injury in being powdered, but which actually contain, when pulverized, a larger proportion of the active constituents than were present in the crude unpowdered substance. This arises from the circumstance that the less active parts are separated and rejected during the process. Thus, for instance, the powder of ipecacuanha, if properly prepared, contains more of the emetic principle than the root from which it is made. The principle upon which the emetic property of ipecacuanha depends exists chiefly in the cortical part of the root, and, as this is the most easily pulverizable, it passes first through the sieve,

while the less active ligneous part, being more tough, remains to the last, and may be, and generally is, rejected as gruffs.

"Besides the loss of water and other volatile constituents, which are driven off in the drying-room, there is also, necessarily, a dissipation and loss, to a certain extent, of solid particles of powder, which are diffused through the atmosphere of the room in which the pulverization is conducted, or which adhere to the apparatus.

"With these exceptions the product, including the gruffs or unsifted part, ought to be identical with the substance it represents; that is to say, should consist of the same particles, and no others, in the same chemical condition as they existed in previously to the process of powdering.

"If no active constituents be lost in the drying process, the strength of the powder will be greater than that of the crude drug, to the extent of the quantity of water and inactive matter which have been separated and rejected. It would be very desirable to ascertain what the average increase of strength is in those drugs which suffer no deterioration in the process of powdering; and also what is the exact nature of the deterioration necessarily sustained by drugs such as myrrh, ginger, cardamoms, and casearilla, which contain, and must therefore lose, active volatile constituents.

"Next to the preservation of the medicinal efficacy of the drug, the most important object for attainment is uniformity of strength in the product. What security has the physician that a grain of opium, or ten grains of jalap, obtained from a particular source, shall be equivalent to the same quantities of those substances obtained elsewhere?

"There are several causes which tend to affect the uniformity of the strength of those medicines which consist of parts or crude products of plants. In the first place, these drugs, in their natural or original state, are not uniform in composition and properties. Different specimens of cinchona bark yield very different proportions of the alkaloid, upon which the efficacy of the drug depends. Other drugs differ to an equal extent; in fact, what drug can be mentioned of which there are not good and bad specimens in the market? The practical knowledge and experience of the druggist are called into requisition in selecting the good from the bad, and thus two classes, at least, are formed. It must be admitted, however, that the criterions of excellence usually adopted in these cases are often founded upon qualities of an extrinsic character, which have no definite relation to medicinal properties.

"There are other causes which affect the uniformity of strength and properties of drugs in their more advanced states of preparation.

"That drugs are sometimes adulterated is a notorious fact. That the practice of adulteration has prevailed to an extent greatly prejudicial to the advancement of the science of medicine, and discreditable to the medical legislation of the country, admits not of a doubt. But a great and progressive improvemant has certainly taken place within the last few years, and there is at the present time an evident desire among wholesale and retail druggists to discourage and suppress the sale of bad drugs.

"We may discard as unworthy of notice the exaggerated statements which have been published with reference to the wholesale substitution of fabricated powders for genuine drugs. Such cases, if they ever existed, must have been isolated and extraordinary exceptions to the practice generally pursued. There is reason to believe, however, that absolute identity of composition between the powders used in medicine and the drugs they represent is not always maintained to the greatest practicable extent; and among the causes tending to this effect there is probably none more influential than the conventional practice of the trade, in reference to the allowance for loss of product during the process of drug-grinding.

"It has already been stated that the loss of weight which drugs undergo in the process of grinding is occasioned by the evaporation of water and other volatile constituents in the drying-room, and by the waste from dissipation in the form of dust, and from adhesion to the apparatus in the grinding-room. It must be obvious that the amount of loss thus sustained will not be uniform: it will vary according to the nature of the substance under operation, and even with substances of the same nature the loss will depend upon the quantity operated upon at a time and their state of dryness when sent to the mill. Some drugs are frequently met with in commerce in a perfectly moist state, such as opium, aloes, scammony, and jalap. The loss of weight in drying these drugs must, of course, be considerably greater than that which occurs with other less moist specimens, or with substances such as rhubarb, ipecacuanha, or bark, which are never met with in a moist state. Now, there is in this variable condition of drugs as to dryness a source of disagreement between the druggist and the drug-grinder, which probably has led to the adoption of a practice that has prevailed throughout the trade, with one or two recent exceptions, of making a uniform allowance for loss of weight in grinding, whatever the nature or quality of the drug might be.

"The rule which for many years has been adopted among the London drug-grinders is to allow four pounds on every hundredweight of the substance ground for loss in the process. Thus, if a hundredweight (112 lbs.) of rhubarb be sent to the drug-grinder's, 108 lbs. of powder, including the gruffs, are returned. It matters not what condition the rhubarb may be in, the drug-grinder is expected to produce 108 lbs. of powder from the hundredweight of raw material. The same allowance is also made, unless otherwise agreed between the parties, for all other drugs which require drying previously to their being powdered. In some cases the practice appears to be to receive 116 lbs. of the undried drug, and to return 112 lbs. of dry powder. This is called the four-per-cent. system, four pounds being the allowance for loss upon every hundredweight of substance powdered. Some substances, however, such as cream of tartar and sulphuret of antimony, do not require to be dried before being powdered, and the allowance for loss on these substances is only two per cent.

"There has until quite recently been only one exception to the adoption, to a greater or less extent, of this, which is called the per-centage or four-per-cent. system, by the drug-grinders of London; and so completely does the system appear to have been established by long custom that, although several attempts have been made to relinquish it, yet there are still some druggists who contend that the specified allowance is a fair average of the loss necessarily occurring in the process of drug-grinding.

"I am indebted to Messrs. S. and G. Allen for a statement extracted from their books showing the loss of weight sustained in powdering drugs at their mills. Every drug powdered at this establishment is weighed when received at the mill; and the ground products, consisting of fine powder and gruffs, are again weighed before being returned to the druggist. These weights are all entered in their books, a separate account being kept for each kind of drug; so that by taking an average of the results upon large quantities, consisting of a great number of specimens received from different druggists, a near approach to a correct estimate is no doubt attained.

The first column of figures in the following table represents the whole quantity of the specified drug which has been ground at several different periods; the second column indicates the greatest amount of loss on any specimen; the third column indicates the smallest amount of loss on any specimen; and the last column gives the average upon the whole.

"It appears from this table that the average loss in powdering drugs is more than four per cent. in nearly all cases, and that in some it is considerably more. Now, can it be reasonably supposed that, in these cases, the drug-grinder will supply good rhubarb, or jalap, gentian, or ginger, for the water which has been imbibed in a damp warehouse or cellar? He is required to make up a certain quantity of powder, evidently more than the crude drug produces, but how is he to do it? Does he keep a stock from which to supply deficiencies of all the drugs he grinds, and go to market and purchase more when his stock is exhausted; or is there some magical power in his mill?

Name of Drug.	Total weight.	Greatest loss per cwt. (112lbs.)	Smallest loss per cwt. (112lbs.)	Average loss per cwt. (112lbs.)
	lbs.	lbs. oz.	lbs. oz.	lbs. oz.
Aloes, Barbadoes ..	379	9 12	0 7	5 12
" Hepatic	997	16 8	3 8	9 6
" Socotrine ..	882	12 0	4 0	9 4
Calumba-root	733	12 0	1 12	6 6
Canella alba	460	12 0	1 0	9 0
Cantharides	1,006	3 0	..	1 8
Cardamoms	348	9 8	2 10	5 12
Casearilla bark ...	794	8 14	2 0	6 0
Cinchona bark, pale	1,547	7 8	4 0	6 6
Cinchona bark, yellow	1,039	11 0	2 8	6 2
Coloeynth.....	1,034	11 8	3 8	6 8
Cubebs	1,551	2 10	..	1 10
Dragon's blood . ..	1,004	13 0	1 4	5 12
Elecampane	1,585	16 0	2 12	9 3
Fœnugreek	2,593	13 0	2 0	7 10
Gamboge	1,009	6 8	1 0	2 12
Gentian-root	5,368	16 0	4 0	9 4
Ginger, Jamaica ..	8,046	12 8	6 0	7 10
Gum arabic	11,215	12 0	4 0	8 0
Ipecacuanha	2,579	7 0	1 4	5 3
Jalap	9,446	15 8	5 0	8 12
Liquorice	1,255	12 0	..	6 3
Myrrh	2,762	16 0	3 12	8 6
Opium	505	18 0	6 9	14 14
Orris-root	3,625	10 12	4 3	6 12
Rhatany	81	8 0	2 10	6 0
Rhubarb, English.	1,346	12 0	3 0	7 13
" Indian ..	5,777	7 0	2 0	6 0
" Turkey .	2,018	8 4	3 0	5 12
Sarsaparilla, Jamaica	689	14 0	1 12	10 1
Scammony	1,161	13 0	2 8	7 4
Seeds, Anise	2,839	16 0	1 0	5 12
" Caraway ...	1,569	13 8	2 8	8 12
" Coriander..	1,063	16 14	1 4	5 9
" Cummin ...	1,142	12 0	1 4	5 4
Senna	606	11 8	3 8	6 6
Squill	974	15 0	8 0	12 8
Tormentilla-root...	231	12 8	2 0	6 12
Tragacanth	2,077	13 12	6 12	8 4
Turmerie	5,663	8 0	1 8	4 0
White Hellebore..	5,533	10 12	2 2	6 4
Valerian root	279	16 8	4 0	8 8

"A drug-grinder's mill is a very different thing from the pestle and mortar of the druggist, although they are both employed for the same purpose. The druggist, when he has used the pestle and mortar, cleans it preparatory for the next operation, by washing it out with water. The drug-grinder also requires to clean his mill. Rhubarb must not be ground after aloes, nor ginger after jalap, without previously well cleaning the ponderous stones and other parts of the apparatus. But how shall this be done? A drug-mill cannot be cleaned by washing it with water,—if for no other reason it would be objectionable on account of its making the room and apparatus damp, which are required to be perfectly dry. Instead of water, sawdust is used for cleaning the drug-mill. After grinding any drug, in order to remove the adhering particles from the mill, sawdust is ground until the mill is rendered sweet and clean.

"Sawdust, then, is indispensable at a drug-mill, as necessary as water is in a druggist's shop, and if the druggist sends damp jalap, containing fifteen per cent. of water, to be ground, and requires dry powder to be returned, with only four per cent. of deduction for loss, he adopts a conventional method of asking for some of the rinsing of the mill—a veritable 'powder of post.'

"The four-per-cent. system cannot fail to induce a reduction in the strength of powdered drugs. If the reduction tended to equalize the strength of different specimens there might be some excuse for it; but the effect of the system must obviously be to cause a reduction, in an inverse ratio to the previous strength of the drugs, so that the weakest and worst drugs will be most diluted. But this objection, which applies to the very principle of the system, is not the most serious objection to which it is subject. It sanctions the practice of admixture, and affords facilities for those who are so disposed to pursue a ruinous competition in price at the sacrifice of quality.

"There are two causes which, I believe, principally tend to frustrate the efforts of those who are endeavouring to put a stop to the adulteration of drugs; one is, the sale of cheap medicines by grocers and others not educated as pharmaceutists, who are unable to distinguish the good from the bad, or indifferent as to which they sell; and the other is, the continuance of the four-per-cent. system in connection with drug-grinding—a system which has no claim for support, save the long-established usage of the trade. It should be the enlightened policy of an educated body of pharmaceutists to afford a fair remuneration for honest industry, and, this being secured, both druggist and drug-grinder would rejoice to be relieved from the hereditary trammels of the present system."

[*To be continued.*]

THE CHEMICAL TIMES.

SATURDAY, JANUARY 13, 1849.

OUR OWN SERIES.

No. V.

ON CHEMICAL MANIPULATION.

Glass Bending, Sealing, and Blowing—(*Continued*).

With the exception of glass-blowing, we have given the reader a general outline of the most important operations on glass for chemical purposes, which are usually performed by aid of the laboratory table blowpipe. Were these articles intended as a code of instructions for professional glass-workers, our description of preceding operations would necessarily have been much more extensive, and it would have been necessary to treat of other manipulative processes in detail; but these papers, we repeat, are intended for the chemist, and the chemist only, whom we would advise never to carry the operation of glass-blowing to a pitch of refinement unrequired by the necessities of his avocation;—never to treat it otherwise than as a means to an end, instead of the end itself. We have known many who, sitting down to make a test-tube, or a syphon, or some other chemical instrument, have ended in frittering away their time by emulating a presumed higher walk of the glass-blowing art; consisting in the formation of poodle dogs, peacocks, ships in full sail, and other glass monstrosities to be seen in popular scientific galleries, and show-caravans.

The operation of glass-blowing, then, properly so called, we regard as the matter of chief importance which remains for us to discuss; certain minor points, however, there are which, perhaps, can be mentioned with greatest propriety here. Of these the operation of expanding the brim of a tube is one.

This operation is generally necessary to adapt tubes, render tubes adapted for receiving a cork, or for pouring liquids. A slight consideration of the direction in which the force of a cork or stopper is applied will render the fact easy to be understood, that the expansion of the cork-receiving end of such tube must greatly increase its power of resisting fracture. In point of fact, whilst the greatest force which fingers can apply will be insufficent to fracture, by the operation of corking, a test-tube of moderate thickness with expanded edge, it is hardly possible to tightly cork an unexpanded test-tube of similar thickness without incurring the accident. The process of expansion is effected by inserting into the mouth of the softened tube a lever of some sort, and carrying it with a sweeping motion around the edge. As to the material of which this lever shall be made, some little consideration is necessary. The young experimenter, if left to his own resources, would probably try a bit of metal, perhaps a piece of thick wire, and, indeed, if heated to a sufficient extent, this answers very well. If applied when cold, however, the operation proceeds very unsatisfactorily, on account of the rapid conduction by the metal, of the necessary amount of heat to retain the glass in a melted state. Some operators employ earthenware for this purpose; for instance, the stem of a tobacco-pipe; others use earthenware pyramids or wire made on purpose, and the operation of which combines the mixed employment of leverage, with the expansive agency dependent on the forcing of the cone, by a rotatory motion in the direction of the axis into the tube; both of which plans answer well. When glass vessels are manufactured on the large scale, this operation is conducted by means of a piece of wood, made wet for the occasion by dipping into a pail of water.

It might be thought *à priori*, that glass exposed to this treatment would immediately crack; and, indeed, such would be inevitably the result if the wetted wood were allowed to remain in contact with the glass after the latter had cooled to the extent of being no longer in a pasty state; which alone, as is evident, could secure the conditions necessary for fracture. Nevertheless, glass so treated receives a great tendency to crack until it has been carefully annealed;—an operation which, on the large scale, is most accurately and studiously performed by means of a furnace-oven built on purpose. On the small scale this annealing process is less perfect; and therefore it is, that the operation of expanding the mouths of tubes by means of wet wood is in this case ineligible. If the wood lever be employed—which we recommend—it should be used dry, and with rapidity and address. It invariably takes fire, and the glass lip is blackened. These, however, are but trivial circumstances. As to the lever, a fresh one may be used, if desirable, for every operation; and the blackness left on the lip being merely due to the deposition of charcoal, not to the reduction of lead;—being, therefore, external, not internal,—may be easily dissipated by holding the blackened part for a sufficient time in the very extremity of the red blowpipe lamp haze.

If, instead of an expanded brim, or, as an addition to it, a lip, have to be made, this is effected by simply pushing the little bar or lever with sufficient force against the part made hot.

In many experimental processes it is necessary to seal or fuse, into glass a wire of brass, or platinum. Of these the latter is always preferable; on account of the little difference between the amount of its expansion and that of glass. The operation should be performed in most instances by first fusing a circumscribed portion of the tube, then touching the fused part with a glass point, and slightly drawing it out into a small tube; the extremity of which being broken, the wire may be inserted; and, by the proper application of heat, may be fused securely into the desired position.

Occasionally, tubes have to be contracted throughout a certain extent of their length. If this extent be considerable, and if the transition from the large to the contracted portion of the tube be gradual,—the operation is accomplished by simply extending the fused tube when its sides collapse: if, however, the contracted portion is required to be more abrupt—a mere neck in fact, then the best way of accomplishing it is by first directing against a circumscribed portion of the tube a fine blowpipe jet; afterwards, when the fusion has proceeded to sufficient extent, exhausting or sucking the air out of the tube by the mouth; when the melted ring of glass collapses, and the contracted neck is accomplished by atmospheric pressure exerted externally.

The operation of glass-blowing, properly so called, now remains to be described, and it may be considered the extreme point of perfection for the chemical table blowpipe operator, who, when he can do this, can perform any necessary kind of table blowpipe operation. Indeed so important is the blowing of glass, that the term has become in process of time a general one, including not only the operation of glass-blowing, within the strict meaning of the term, but every operation on glass whatsoever, conducted by the agency of fusion.

It need hardly be explained that the operation of blowing into a glass tube, closed, and fused either at one end or mesially, will be followed by the expansion of such portion of fluid glass, into a bulb. The former operation is the most easy, as it is the most frequent; therefore we will consider it first.

In general the operation of blowing a bulb should be conducted as follows:—Regard being had to the thickness of the tube to be operated upon, the size of the bulb desired, and the uses to which it is to be put—whether it will have to sustain much pressure, or the contrary; whether it shall afford great facilities by means of its thin walls to the transmission of heat, &c.; the operator will determine whether or not he must preface his expanding process by one of thickening. With a naturally thick tube this preliminary will be in general unnecessary; otherwise it will be, for bulbs of any size, indispensable. In first preparing the tube to be expanded, it is necessary to heat it much more than would be desirable for any of the processes hitherto described; otherwise the operator's breath will be found not to have the requisite amount of power. It should, therefore, be held close to

the blue or hottest part of the blowpipe flame until it assumes the consistence of thin paste and begins to droop; the tube then should be rapidly removed, held horizontally, or the heated end slightly looking upwards, and, whilst constantly revolving on its axis, air should be forced in by means of the *buccinators* or muscles of the cheek, not directly by air from the lungs; for not only in this case would the operator have less initial power to cause the expansion to begin; but, when begun, he would not have sufficient control over it, his breath not being under immediate command;—and the result would be the formation of a large, irregular, drooping, and useless bulb.

Some operators, instead of holding the tube horizontally as we have described, place it in a dependent or vertical position,—which effectually prevents the bulb from drooping on one side,—but is attended with the disadvantage of forming a neck between the bulb and parent tube. It will be anticipated, however, that sometimes this neck is desirable, as also is a drooping bulb. In the formation of a retort, for instance, the bend is accomplished by the latter means. When desirable, of course, these plans of gaining a definite end should be followed. They involve an agency—for evil if uncontrolled, for good otherwise. Frequently it will be that the first effort of blowing does not form a bulb of the size or regularity desired, in which case it should be heated again, but not in the manner already directed. Heat was previously applied to a thick tube: it is now to be applied to a thin bulb of comparatively large area. The kind of flame required, therefore, is one that is more diffused, but not violent. The irregular, roaring flame already indicated in a previous article is here the kind to be employed, and is produced by removing the jet some distance from the flame.

THE RESPONSIBILITY OF DISPENSERS.

We never remember to have heard of a grosser dereliction of duty by a dispenser, than that which formed the subject of complaint by Mr. M'Dougell to Alderman Farebrother, at the Guildhall, on Monday last; and which appears in another part of our columns. Mistakes by dispensers we have heard of—some of them resulting in death; but it would be difficult, we believe, to find a case displaying a case of glaring error, which might have been fatal, treated by the erring party with indecorous levity and nonchalance.

A draught had been ordered, consisting of henbane and camphor mixture; a most simple dose, presenting two of the commonest therapeutic agents in their most usual forms:—the prescription legible, devoid of any out of the way technicalities; and perfectly intelligible, as it turned out, to the dispenser himself. Instead of this draught,—tincture of henbane in an ounce and a half of camphor julep,—the dose of henbane in an ounce and a half of paregoric was substituted, and sent out, without directions. Although to this latter blunder the patient's life is due, the dispenser is not the less culpable. Whilst he ought to have regarded it as a fortunate circumstance, he would—had he felt but a tithe of that moral responsibility which we trust, and believe, the majority of his class possess—have also regarded it with shuddering,—as a kind of providential interposition!

Far from this, on being remonstrated with, and asked for an explanation, he treated lightly of the matter,—as *merely* a mistake!

The whole case is one that was likely to have reacted very painfully on the professional credit of Mr. M'Dougell. It appears that he had on this occasion exactly doubled the previous dose of henbane, which his patient had been in the habit of taking; therefore, had the poisonous draughtbeen swallowed—poisonous by a narcotic ageney—the patient would have died. Mr. M'Dougell would have been open to the charge of having killed his patient by the administration of a double dose, and probably the dispenser's misdoings would never have come to light.

Very illustrative of the popular ignorance,—as to what public body, the responsibility of taking cognizance of such a misdemeanour belongs, was the question of Alderman Farebrother;—whether Mr. M'Dougell had laid the matter before the authorities at Apothecaries'-hall? The question in itself was rational enough: the alderman yielded to the guidance of his business-like common sense. What body *should* with such propriety see to these matters as the Apothecaries' Company? It is hardly neeessary to say that we are not upbraiding the company, well aware that they have no legal power over the chemist and druggist, who, in point of fact, has become virtually the apothecary—as the apothecary has elevated himself into the physician—all except the name.

The apothecaries have, however, attained a social position so far above their ancient status, that we believe they would not desire to have the legal power delegated to them of discharging the functions of the apothecary of Germany and of France.

There is a body which, if properly alive to its duty, should see to this and similar matters. We mean the Pharmaceutical Society. Much has of late been said against the former indiscriminate granting of the diploma of the society to every subscriber, and of recalling the diploma so soon as the subscription might have lapsed. The course, indeed, is open to much censure, and to many injurious suppositions. To recal the diploma—to strike off the list—or otherwise censure a recklessly careless dispenser, would, however, be an act of wisdom no less than of justice; an act that would redound to the honour of the Pharmaceutical Society, and which would be carped at by none.

DECREE OF THE GOVERNMENT OF THE UNITED STATES RELATIVE TO THE IMPORTATION OF DRUGS, CHEMICAL AND MEDICAL PREPARATIONS, &c.

Art. 1. Decreed by the Senate and the Chamber of Representatives of the United States, in Congress assembled, that from the day of promulgation all drugs (medical preparations), including all essential oils and chemical preparations used as medicines, imported into the United States, shall, before leaving the Custom-house, be submitted to an examination, for the object of proving their quality, purity, their fitness for medical use, and, finally, their general value and identity.

Art. 2. All medical preparations, chemical or otherwise, ordinarily imported under the name of the manufacturer, shall have their real name, together with the name of the place where they have been manufactured, legibly written on a prescribed stamp. All preparations not provided with this formality are subject to confiscation.

Art. 3. If the said drugs, medical preparations, chemical or otherwise, or those including essential oils, after examination, are proved to be adulterated or injured, in a manner so as to render them inferior in quality and purity to the samples established by the Pharmacopœias and Dispensatories of the United States, Edinburgh, London, of France, and Germany, consequently dangerous, and improper to be used for medicinal purposes, a report shall be made thereupon; and the said articles shall not be taken out of the Custom-house, unless it should, by a new examination (which the owners or consignee may claim), be proved that the first examination was erroneous, and that the articles may be employed medically without causing any danger.

Art. 4. If the owner or consignee should not be satisfied with the first examination he has the right to demand another analysis, to be made at his expense; and, on his depositing a sufficient sum as caution money, an experienced chemist will be assigned to him, whose election is agreed upon by the College of Medicine and Pharmacy, and who will make a scrupulous analysis of the articles in question, and report on it upon oath. In case this second report, which is to be definitive, should declare the first examination to have been erroneous, and the articles examined to be in conformity to the rules mentioned above, they will be admitted on payment of the ordinary expenses of the Custom-house. But if, on the contrary, the second report should confirm the first, the said articles will remain consigned in the hands of the collector; and the owner or consignee, on paying the duties of warehousing and other usual expenses, and, further, on engaging to transport the articles in question beyond the frontiers of the United States, will have the power of reimporting them after a lapse of six months from the date of the second report.

This period once elapsed, and the articles in question not having been exported from the frontiers of the United States, the collector is bound to have them destroyed, and the owner or consignee is made responsible for the payment of all expenses just as if they had been exported.

Art. 5. The Secretary of the Treasury is for this purpose authorized to reserve certain sums of money necessary as a salary to a defined number of experienced chemical examiners in the ports of New York, Boston, Philadelphia, Baltimore, Charleston, New Orleans, &c. &c. He is at the same time to give to the receivers at the Custom-house such instructions as he may think necessary to oppose the importation of any adulterated drugs and medical preparations.

The other articles of this decree relate to measures of administration which are to be adopted in consequence of the preceding statutes. The College of Pharmacy of New York, at their sitting of July 6, 1848, adopted several resolutions referring to the decree above mentioned, and the object of which is to facilitate its execution. All colleges of medicine and pharmacy of the United States, and the principal journals of medicine and pharmacy of that country, as also the pharmaceutical journals of other countries, have received copies of the same decree.

PROGRESS OF THE CHOLERA AND GENERAL MORTALITY IN LONDON.

Although the cholera still continues in the metropolis, the locality of the disease has changed, the greater number of cases not occurring now, as heretofore, on the south of the Thames, but on the eastern side of London, and the western suburbs; still, however, to no great amount, although manifesting extreme

virulence as regards degree of mortality for the numbers attacked.

The disease, however, still continues to extend with great activity and with undiminished mortality (for the number of remaining inmates) in Mr. Drouet's institution for pauper children in Lower Tooting; and, worse still, the disease has broken out amongst the children in the St. Pancras workhouse who had never been in the establishment at Tooting, nor had any communication with the diseased children from that establishment.

Much has been written about the condition of certain drains near the Tooting establishment as probably being the remote cause of the disease, and a writer in the *Times* of Wednesday proposes to deodorize and disinfect them by means of charcoal. Unfortunately charcoal would exercise no such beneficial agency to any great extent. Mr. J. F. Rose, surgeon, addresses a note to the same journal — which we publish in another page — expressing his belief that the disease in Tooting is not cholera, but fever. The opinions concerning this mysterious disease acquire consistency at last, most people, we believe, recognising in cholera only an aggravated kind of fever, the type of which, according to Dr. Billing, is ague; according to others, typhus.

GENERAL MORTALITY IN LONDON.

The return of births and deaths registered in London during the week ending on Saturday last states the births to be—males, 726; females, 586; total, 1,312; the deaths—males, 565; females, 566; total, 1,131; the weekly average of deaths derived from the deaths of 1844-8 (and corrected for increase of population) being 1,169. All the deaths except two have their causes assigned; the numbers being as follows:—Deaths from zymotic diseases 359, average 221; from dropsy, cancer, and other diseases of uncertain or variable seat, 42, average 54; tubercular diseases 165, average 203; diseases of the brain, spinal marrow, nerves, and senses, 109, average 141; diseases of the heart and bloodvessels 39, average 40; diseases of the lungs and of the other organs of respiration 203, average 243; diseases of the stomach, liver, and other organs of digestion, 60, average 67; diseases of the kidney, &c., 7, average 13; childbirth, diseases of the uterus, &c., 7, average 9; rheumatism, diseases of the bones, joints, &c., 13, average 7; diseases of the skin, cellular tissue, &c., 2, average 1; malformations 4, average 3; premature birth 24, average 23; atrophy 23, average 15; age 47, average 73; sudden 6, average 14; violence, privation, cold, and intemperance, 19, average 37. In the details of these items the deaths from scarlatina are stated to have been 81, the average being only 32; but in the week ending October 14 they reached 188; the number has been gradually abating ever since. The week's deaths from cholera were 61, a larger number than in any week of the past quarter except the weeks ending November 4 and November 11, when they reached 65 and 62. During December they averaged 28 a week. A woman is stated to have died of "natural decay" in St. Margaret's, Westminster, at the advanced age of 100 years. In all the districts on the north side of the river the deaths in the week were below the average. For the south districts the deaths were 354, the average being 319. The highest point at which the thermometer stood in the sun was 48° 9, which was reached on the 6th inst.; the lowest, on the grass, was 17° 2, on the 2d inst. The following are the particulars of the fatal cases of cholera during the week; one is a case where an inquest was held; the remainder are all certified by medical attendants. Of the 61 deaths, 48 occurred in Mr. Drouet's institution, the remaining 13 in other parts of the metropolis:—

Chelsea; South.—F. 1, "cholera maligna (106 hours)."

St. Pancras; Gray's-inn-lane.—M. 6, "Asiatic cholera (14 hours)." F. 9, "Asiatic cholera (10 hours)." Mr. J. Worrell, the registrar, states that "the above two cases are those of pauper children in Holborn Union, brought from Drouet's school at Tooting."

Bethnal-green; Hackney-road.—F. 47, "Asiatic cholera (53 hours)." Mr. Murray, the registrar, states that "the circumstances of the deceased were comfortable, and the neighbourhood not overcrowded. The house in which she lived was well drained. Her habits had been intemperate, and the disease seems to have been accelerated by eating sixpennyworth of dry fish immediately before the attack. It is the only case of cholera which has occurred hitherto in this locality."

Whitechapel; Goodman's-fields. — At 88, Leman-street, F. 30, "cholera (3 days), consecutive fever (10 days)." In same house, F. 26, "Asiatic cholera (15 hours)." In same house, F. 23, "Asiatic cholera (31 hours)." "The house where the above three cases occurred has been fitted up by the Whitechapel Union guardians for cholera patients."

St. Olave; St. John's.—F. 59, "cholera Asiatica (20 hours); exhaustion (10 hours)."

St. George, Southwark; London-road.—F. about 50, "malignant cholera (5 days)."—Inquest.

Newington; Walworth.—F. 6, "cholera (2 days;" F. 18, "English cholera (3 days)." Mr. Turner, the registrar, states that "this young person, who had come from Ireland, and had been in London about a month, was one of the casual poor, and had slept two nights in the asylum for the houseless which adjoins the workhouse at Walworth. On Tuesday evening she was found to be very ill, and was at once admitted into the house, where she had medical attendance. She died the following morning."

Greenwich; Greenwich West.—In Dreadnought Hospital, M. 28, "cholera, acute laryngitis—death on second day (p.m.)."

Wandsworth and Clapham; Battersea.—At union workhouse, son of a single woman, 6, "cholera (24 hours)."

Wandsworth and Clapham; Streatham and Tooting.—Mr. Drouet's infant poor establishment, Surrey-hall, Tooting Graveney. The following list contains all the deaths in this house, registered in the week, inclusive of four deaths not certified as caused by cholera:—F. 9, "vomiting (18 hours); diarrhœa; collapse." M. 6, "vomiting (21 hours); diarrhœa; collapse." F. 4, "vomiting and diarrhœa (8 hours); collapse." M. 5, "vomiting (19 hours); diarrhœa; collapse." F. 7, "vomiting and diarrhœa (12 hours); collapse." F. 8, "vomiting (5 hours); diarrhœa; collapse." F. 10, "cholera (15 hours)." F. 10, "cholera (14 hours)." M. 10, "cholera (21 hours)." F. 5, "cholera (14 hours)." M. 5, "cholera (13 hours)." F. 6, "cholera (5½ hours)." F. 6, "cholera (12 hours)." F. 2, "cholera (21 hours)." F. 3, "cholera (38½ hours)." F. 8, "cholera (11½ hours)." F. 4, "gangrene (1 week); exhaustion (3 days)." F. 8, "cholera (2 days)." M. 11, "cholera (3 days); exhaustion." F. 3, "fretting for loss of mother (14 days); debility." M. 13, "cholera (13 hours)." M. 10, "cholera (11 hours)." M. 4, "cholera (3 days); exhaustion." F. 7, "cholera (24 hours)." M. 13, "pneumonia (3 days)." F. 9, "cholera (3 days); exhaustion." M. 13 "cholera (38½ hours)." M. 4, "cholera (28 hours)." F. 5, "cholera (10 hours)." M. 5, "cholera (5 hours)." M. 3, "general debility (14 days), convulsions (24 hours)." F. 14, "cholera (6 hours)." F. 7, "cholera (38½ hours)." F. 6, "cholera (82 hours); exhaustion." F. 6, "cholera (3 days); exhaustion." M. 14, "cholera (3 days); exhaustion." F. 9, "cholera (40 hours)." M. 8, "cholera (8½ hours)." M. 5, "cholera (15 hours)." F. 11, "cholera (20 hours)." M. 7, "cholera (12 hours)." F. 8, "cholera (21 hours)." M. 4, "cholera; exhaustion (5 days)." M. 9, "cholera (10½ hours)." M. 11, "cholera (12½ hours)." M. 11, "cholera (17 hours)." F. 4, "cholera (48 hours)." F. 7, "cholera (24 hours)." M. 13, "cholera (6½ hours)." F. 10, "cholera (23 hours)." M. 9, "pneumonia (3 days), cholera (24 hours)." F. 10, "cholera (3 days); exhaustion."

The Cholera in Hertford Gaol. — On Tuesday a meeting of the visiting magistrates was held at the Shire-hall, Hertford, to take into consideration the state of the gaol, in which the cholera had broken out to an alarming extent. The Government inspector, Captain Williams, attended from the Secretary of State's office. Thirteen cases of cholera and premonitory diarrhœa had occurred, of which only four cases have hitherto proved fatal. The magistrates resolved to send a statement of the circumstances to the Secretary of State, and in the meantime have taken every possible precaution to prevent any further extension of the disease.

MISCELLANEA.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING JANUARY 4, 1849.

William Gilmour Wilson, of Port Dundas, Glasgow, engineer, for improvements in the formation of moulds, and cores of moulds, for casting iron and other substances. Patent dated December 30th, 1848; six months.

William Knapton, of the city of York, ironfounder, for certain improvements in the mode of manufacturing gasometers and gasholders. Patent dated January 3d, 1849; six months.

William Thomas, of Cheapside, in the city of London, merchant, for improvements in the manufacture of window blinds. Patent dated January 4th, 1849; six months.—(Communication.)

David Yoolow Stewart, of Montrose, in the kingdom of Scotland, ironfounder, for improvements in the manufacture of moulds and cores for casting iron and other substances. Patent dated January 4th, 1849; six months.

Henry Francis, of Chelsea, engineer, for improvements in sawing and cutting wood. Patent dated January 4th, 1849; six months.

Robert Mann, of Stareh Head-mill, near Rochdale, in the county of Lancaster, cotton-spinner, for certain improvements in looms, and apparatus connected with looms, for weaving various descriptions of textile fabrics. Patent dated January 4th, 1849; six months.

William Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. Patent dated January 4th, 1849; six months.

GROSS DERELICTION OF DUTY BY A DISPENSING CHEMIST.

At Guildhall, on Monday, the 7th inst., Mr. Henry John M'Dougell appeared before Alderman Farebrother, to ask his advice under the following circumstances:—

Mr. M'Dougell said that his application not only involved the safety of the public against ignorance or wilful negligence, but also to protect the profession to which he belonged from errors which, if they terminated fatally, would materially damage their reputation. The case was as follows:—A short time since a patient was sent up from the country and placed under his care, when, instead of giving him opium, which the person had been accustomed to take, he ordered him a sedative of henbane and camphorated water. He afterwards considered it proper to administer a double dose, and accordingly wrote a prescription, which was taken to Mr. Hooper, the chemist and druggist, at London-bridge, where one of the assistants made the mixture up, and gave it to the messenger, having only written the word, "Mixture," without saying how it was to be taken, according to what was said in the prescription. Fortunately, on calling on his patient the next day, that person informed him that he had not touched the medicine, as there was no direction on the bottle. On looking at the mixture Mr. M'Dougell dis-

covered that, in addition to the henbane ordered, the assistant had mixed up a portion of paregoric, containing three grains of opium and an ounce and a half of spirits, instead of camphorated water, so that had the dose been taken he should have found his patient dead, to the great detriment of his professional character. On discovering what had occurred, he proceeded to Mr. Hooper's shop, and saw the two assistants, and on inquiring what the bottle contained one of them replied about three parts paregoric. He then requested the assistant to read the prescription which he sent, who having done so correctly, he inquired why his directions had not been complied with? when both parties treated the affair with great levity, and said that "It was only a mistake." Under these circumstances he wished to know what course he ought to pursue to make parties amenable to the law for such conduct, which was now of frequent occurrence, and which in several instances in the country had terminated fatally through similar negligence?

Alderman Farebrother asked if the prescription was legibly written?

Mr. M'Dougell replied that it was, and any one could easily read it.

Alderman Farebrother wished to know if applicant had been to Apothecaries'-hall on the subject?

Mr. M'Dougell said it would be useless, as the chemists and druggists had taken the place of the old apothecaries, and were not subject to any examination as to qualification.

Alderman Farebrother then asked what specific complaint he had to make?

Mr. M'Dougell replied that his complaint was—first, the making up of a poisonous ingredient; secondly, that too much was sent; and, thirdly, that no direction was written as to how or when it was to be taken.

Alderman Farebrother said that the last fault was a most fortunate one for the patient, as most likely if he had taken it at night, as directed in the prescription, he would have been found dead the next morning.

Mr. M'Dougell had little doubt about it, and then the blame would have fallen on him for ordering a double dose, as from paregoric the cause of death would not be so speedily observed as from other poisons.

Alderman Farebrother granted a summons against Mr. Hooper for having, through gross ignorance or criminal negligence, allowed such a poisonous compound to be made up instead of the proper prescription sent to him.

Gold-seeking in California.—The gold-hunting mania still rages with unabated vigour, and the primitive state of honesty so much lauded in earlier communications unfortunately given place to theft. Nay, blood has flowed, murders have been committed, for the sake of hidden treasures of gold. All government, civil and military, seems to be at an end in the gold districts; whole crews run from their ships, whole companies of American soldiers desert, and labourers can hardly be found for the most exorbitant wages. Whatever good the United States may derive eventually from the newly-discovered mineral wealth, it is abundantly evident that they will have much trouble to bring the unruly denizens of California under temperate control, and to make a civilized rule respected. The following is from a correspondent at Lima:—"About forty leagues from Monterey, on one side of the river Sacramento, which runs into the Bay of San Francisco, a tract of land has been already explored, to the extent of 100 miles in length and as many in breadth, strewed with pieces of native gold from a grain to a pound in weight, the metal being of the finest quality, 23 1-10 carats. To what further extent the tract of gold land may run is not yet ascertained. Sailing-vessels of 70 tons, and steamers of 200, can go up the river to the commencement of this region of riches. The results of this discovery so far are the 5,029 ounces of gold brought up in the Lambayecana, according to manifest presented in the Payta Custom-house; the four packages which the officer is carrying home to the United States Government; and three ships, which left Monterey direct for Chili, each having also a quantity of the gold on board. The Lambayecana has scarcely two able seamen in her crew, and the wages of these are 80 dollars per month; and the captain was paid 900 dollars for touching at Payta to land the American officer; after which she continued her voyage to Valparaiso. Eleven vessels at anchor at Monterey were deserted by their crews, and even some of the captains left to go in quest of gold. The ships of war were obliged to proceed to sea in order to prevent becoming wholly unmanned. The company to which the American officer belonged, and which consisted of 200 men, was disbanded altogether, every one hastening to the gold. Wearing apparel, provisions, and labour have risen enormously:—70 dollars have been paid for a cap, and that not a new one; 20 dollars for a small sack of flour; and 24 dollars for a box of seidlitz powders. A man was paid 6 dollars for helping to load a cart, and where the gold is a blanket is worth 80 dollars. The Governor of California is obliged to cook his own meals, he not being able to procure a cook, even at the high rate of 300 dollars per month. Some individuals have collected from 300 to 800 dollars a day, and others, for several days running, from 75 to 150 dollars; and when the product of any spot does not exceed 30 or 40 dollars it is abandoned, and a richer part sought after. The gold exists from the surface down to twelve feet beneath it, the larger pieces being on the surface, and the size diminishing with the depth, till at the depth mentioned it disappears altogether. The discovery of this immense deposit of metal was quite accidental. In the spring Messrs. Marshall and Bennett, in digging a ditch for the purpose of erecting a saw-mill, found a few grains of pure gold, which the current of the river had conveyed to that spot. The news was soon spread about, and the river searched, both above and below the place chosen for the saw-mill; and, gold being found in both directions, it led at last to the discovery of the district here mentioned. The consequence was, that all persons abandoned their houses and proceeded to gather up the precious metal; and, as no further capital was required than a basket and a knife, or a bullock's horn, to break the ground, the labourers are now the richest individuals in the country. The few merchants and speculators, who, a short time ago, were the only wealthy men of Upper California, must now go and share the labour of the workmen, if they do not intend to remain relatively poor, for they can get no one to work for them; each man collecting gold on his own account, or, by mutual agreement, several sharing the product of a day's labour between them."

Proposed Submarine Telegraph between England (Folkestone) and France.—A most interesting telegraphic experiment has taken place at Folkestone with a submarine telegraphic wire, preparatory to the sinking over the Straits of Dover a properly insulated telegraph. The process followed was that of starting about noon a steamer belonging to the South-Eastern Company, with the necessary apparatus on board, and reeling off by means of a drum the wires continuously for two miles out at sea. The experiment succeeded perfectly, in consequence of which we understand a telegraphic communication is forthwith to be established between England and France. The experiments were made at Folkestone harbour, under the direction of Mr. Walker, the superintendent of the South-Eastern Company's telegraphic system, and on board the Princess Clementine, one of the company's steamers. Among the visitors present were, Sir Howard Douglas, Colonel Tylden, R.E., and other engineer officers from Dover, Colonel Beresford, R.A., Major Spiller, R.A., Captain Jackson, R.A., Captain Alderson Bailey, Licutenant Essell, R.N., Mr. Weckes, of Sandwich, Mr. Renshaw; Mr. Hatcher, secretary of the Electric Telegraph Company; Dr. Bachhoffner, &c. Among the residents of Folkestone who were upon the pier was M. Caussidière, ex-Prefect of Police. It was intended to have taken the wire for two miles out to sea, but the wind having risen in the night, and a smart breeze in the morning having caused a swell, it was considered that the steamer would have pitched and rolled too much for the safety of the wire, and that it would also have been impossible to manage the instrument so as to have kept the needles upright. Upwards of two miles of wire were, therefore, carried out in a small boat and submerged in the sea along the mouth of the harbour and at the side of the pier. One end of the wire was connected with a telegraphic instrument on the deck of the steamer, and the other end with the telegraph wire communicating with London. The arrangements having been completed, about half-past twelve the telegraph was placed in communication with London, and a message was sent by Mr. Walker to the chairman of the South-Eastern Company to inform him that the experiment was entirely successful. A continued correspondence was kept up between the Princess Clementine and the stations of London, Ashford, and Tunbridge, which was continued with the most perfect success at intervals for three or four hours, messages being interchanged between the steamer and all these stations. The bells at the electric telegraph offices at Tunbridge and London-bridge were vigorously rung by the instrument on board the Princess Clementine, and no greater difficulty was experienced in making the signals with the submarine conductor than with the ordinary wires on land. The wire employed, the total length of which was 3,600 yards, was made in accordance with a suggestion from Mr. Walker, *i.e.*, it was coated with gutta percha. The size of the wire used is No. 16 copper wire, and its thickness when covered with gutta percha is nearly a quarter of an inch in diameter. The wire used is to be employed in the Merstham tunnel, and a similar wire will be placed in all the tunnels on the line, the Shakspere, Abbott's Cliff, and Martello tunnels being already provided with wire of this kind. The defective insulation of the wires against which this new wire was intended to provide has been the only serious practical difficulty which has had to be overcome in working the electric telegraph. Hitherto the working of the wire, as covered with gutta percha in the tunnels, has been very satisfactory; and its durability, and the complete insulation which it effects, appear to have suggested its applicability for the purposes of submarine telegraphic communication. The wire is patented by Mr. Foster, of the gutta percha manufactory at Streatham, who assisted at the experiments. Three or four specimens of wire were exhibited on board, one or two of them being, probably, better adapted to the experiment of a communication across the thirty miles of channel than the wire actually used. Among them were specimens of No. 8 and 14 galvanized iron wire, a three-twisted No. 16 copper wire, and also the single copper wire used in the experiments, but all of these being coated much more thickly with gutta percha than that actually used, some of them being in the whole nearly three quarters of an inch in diameter. One of these Mr. Walker proposes to lay down permanently across the Folkestone harbour in place of the wires now carried at the back of the Pavilion Hotel, in order thereby to connect the harbour station with the thorough communication by the mainland. We understand that the coil of two miles of wire used in the experiments will be in the library of the Royal Institution on the 19th of January, the first Friday of their session. A needle telegraph fitted up with lightning conductors and movable coils, upon a plan invented by Mr. Walker, is deserving of a brief explanation. It is well known that the aurora borealis, as well as certain states of the atmosphere, affect the needles and cause them to hang many degrees out of the perpendicular. The deflection from these causes is generally so great that the

needles are brought up close against the stops, and cannot be moved further in that direction. By the simple mounting of the galvanometric coils on moveable wheels the needle is easily brought to a perpendicular state by turning a stud and causing the coil to pass in a direction opposite to that to which the needles had been deflected. By this means the power of making telegraph deflections in both directions is regained, and the instrument may be worked without difficulty. The lightning conductor in Mr. Walker's invention consists of a vertical wire furnished with radiating points, and a bobbin of finer wire than any used elsewhere on the instrument. This is surrounded by a small brass cylinder connected with the earth, by which arrangement the lightning-charge has the best possible course to the earth. Any overcharge would burn the little coil of wire, and escape to the earth without injuring the instrument. This actually occurred at Tunbridge Wells during the last thunderstorm. About four o'clock the submerged wire was drawn in and wound up without having sustained the least damage. Mr. Renshaw expressed himself highly gratified with the perfect success of the experiment, and congratulated Mr. Walker on the result, which he said he should have great pleasure in reporting to a meeting of his brother directors. Every one on board appeared to be equally satisfied with the experiments so far as they went, and which may be taken to establish the practical value of a submerged telegraph wire insulated by gutta percha. With respect to the practical bearing of these experiments upon the possibility of establishing a telegraphic communication with the opposite coast, there appears to be no greater difficulty in running out and communicating along thirty miles of such wire than along two miles. All that would be requisite would be to determine the kind of wire proper to be used, which would be most likely a twisted iron wire coated with gutta percha, as in some of the larger specimens exhibited. We hear that Mr. Foster expresses himself so confidently respecting the complete insulation gained by his preparation that he is willing to find the gutta percha necessary for coating a wire of sufficient length to stretch across the Channel whenever the railway directors consent to supply the wire. The chief difficulty would probably be, not in effecting the communication, but in maintaining it, and we were, therefore, anxious to learn Mr. Walker's views respecting the probability of the fracture of the submerged wire by the dragging of ships' anchors, the bites of the larger sea fish, and other casualties. Mr. Walker would provide against these accidents by having two or three wires between each port, say Dover and Calais, or Folkestone and Boulogne. These wires he would run out in different tracks across the Channel, and by this means, and by not making the communication dependent at either port upon a single wire, the probabilities would be greatly against their all being broken on the same day. In the event of one of the wires being fractured, the South-Eastern Company, in their powerful fleet of steamers ready at their command at both ports, possess great facilities for promptly discovering and fishing up the broken wire, when its repair would be the work of a very short time."

A Dispenser as he Should not Be.—The dispenser who licks the lip of the syrup-bottle, after pouring out what he requires, who removes any foreign body from a mixture by putting his fingers into it, or puts a cork between his teeth to soften it and make it fit the mouth of a bottle, might be compared to an ill-bred person who, at meal time, drinks from the decanter, helps himself to salt with his fingers, or cuts bread from the loaf with a knife which has just been in his mouth. He who prepares the dose for the sickly, and often fastidious, patient should be especially careful that he add no extraneous repulsiveness to that which of necessity belongs to the prescribed remedy.—*Wöhr and Redwood's Pharmacy.*

Is the Cholera at Tooting?—Mr. J. F. Rose, surgeon, of 60, Stamford-street, denies that the cholera is at Tooting in the following letter to the *Times*:—"Sir,—I was requested by one of the guardians to visit the sick children belonging to the Holborn union, who had been removed to the Free Hospital in Gray's-inn-lane from Mr. Drouet's house at Tooting, and, accordingly, I attended there on Sunday and Monday last, and carefully inspected all the children under treatment, about sixteen in number, and as I saw a great many cases of cholera of the worst description in 1832-33, and as much alarm has been excited in the public mind by the Tooting cases, perhaps you will allow me through your columns to make known to the profession the symptoms of the disease I observed in these children, and I think it will be universally admitted that their cases differ very materially from those which the cholera exhibited when it prevailed last in this country. The marked symptoms of Asiatic cholera are collapse, total loss of pulse within an hour or two of the attack, vomiting, rice evacuations, peculiarly pinched features, not to be mistaken; altered intonation of voice, suppressed secretion of or locked-up bile, suppressed urine, cold extremities with blue tint, incessant thirst, violent cramps in the stomach and limbs, constant restlessness, and great desire for more freedom of breath. Now, none of the children I saw in the Free Hospital had cramps, the blue tint, the loss of pulse (save one, which was *in extremis*), the peculiar pinched features, the suppressed secretions of bile or urine, the peculiar alteration of voice, nor great restlessness; but the symptoms exhibited were such as generally are seen with low bilious fever, accompanied by diarrhœa. The patient lay quiet and had not much pain, the evacuations were not copious, nor of rice colour, the pulse small and frequent, the countenance little changed, the skin warm and moist, excepting in the case before alluded to; but there was the sunken eye, the low feeble voice, and the collapse, which appeared to arise from want of power in the constitution to bear up against the attack, and to produce reaction, or the secondary stage of fever, occasioned, I should say, principally from the quality of their dieting being too low, from their apartments not being sufficiently warmed and ventilated, and from their clothing not being adapted to protect them from the sudden variations in the climate. It is obvious, too, that the disease cannot have been produced by atmospheric influence. No child in Tooting, out of Mr. Drouet's establishment, has been similarly attacked, nor do I learn that any adult of the house, whose dieting was doubtless of a more substantial nature, has had the complaint. It is perfectly well known to the profession that a low bilious fever, accompanied by diarrhœa, has prevailed to a great extent in London for several months past, presenting most of the symptoms of the disease which has attacked these children, and in most instances it has been treated with success; but few medical men, I apprehend, have been induced to designate it cholera, and, at all events, I know that I have not thought it requisite to report the many cases of the kind which have occurred in my practice as cases of cholera to the Board of Health." If Mr. Rose be disposed to allow (as we think he must) that the symptoms of disease may vary amongst themselves, the disease being essentially the same, he will be in accord with the opinions of a large number of modern pathologists who recognise in cholera only an exaggerated kind of fever.

Opening of Islington Cattle Market.—On Tuesday the New London Cattle-market was opened for the sale of beasts and sheep. The ceremony was very numerously attended, and the whole of the stock brought to the market was sold. The market opened at eight o'clock, and at its close at three o'clock a *déjeuner* was served in the market-house, at which Mr. Armstrong, who has been one of the chief promoters of the undertaking, presided.

Baths and Washhouses, Goulston-square. The numbers of those who have bathed at the model establishment in Goulston-square, Whitechapel, to December 30, 1848, are—First-class, warm, at 6d. each, 15,914; first-class, cold, at 3d. each, 1,832; second-class, warm, at 2d. each, 53,617; and second-class, cold, at 1d. each, 9,466. Total, 80,829. The great proportion of second-class warm baths proves that the labouring classes in the densely-crowded and poor district in which the establishment has been placed appreciate its advantages.

Cascarilline.—The bitter crystalline matter thus called was discovered by Mr. Duval in the bark of cascarilla. He prepared it by first exhausting the bark by water, precipitating the solution by acetate of lead, filtering, separating the lead by means of hydrosulphuric acid, evaporating the liquor to a third of its volume, treating with animal charcoal, and evaporating spontaneously in a warm place. Gradually there collects on the surface a crystalline matter, which must be removed when the liquor becomes cold, but before it has acquired a syrupy consistence. This matter sometimes deposits on the surface of the glass, in which case it presents a resinous character. The liquid is next separated, and the deposit treated with alcohol of seventy-eight per cent. The alcohol dissolves the colouring matter and the fat. After decantation the residue is dissolved in alcohol of ninety per cent., and animal charcoal is added. Filtration is then performed, and the solution allowed to evaporate spontaneously in a warm place. The crystals which result should be then washed with cold alcohol, and recrystallized by spontaneous evaporation. Cascarilline crystallizes in colourless needles and in hexagonal scales. It is devoid of odour, and leaves a persistent taste of bitterness in the mouth. By fusion it becomes transparent, and on cooling concretes into a resinoid mass. When burned it leaves no residue, and yields no ammonia when mixed with hydrate of potash and exposed to dry distillation. It is a perfectly neutral body, slightly soluble in water, and its solution precipitating none of the metallic salts, not even the basic acetates of lead. Solution of potash does not render it turbid. It is soluble both in alcohol and in ether. It also dissolves in sulphuric acid, to which it communicates a red tinge. From this acid solution the addition of a portion of water precipitates a small portion, and changes the previous red colour to green. If more water be added, then the whole is precipitated, and the liquid becomes colourless, but the precipitate is green. This precipitate when treated with ammonia acquires a yellow colour, but is not dissolved. Hydrochloric acid dissolves cascarilline, and yields a violet-coloured solution: a little water renders it blue, and if more be added it becomes green. Cascarilline also dissolves in nitric acid, and produces a yellow-coloured liquor, from which ammonia throws down a precipitate insoluble in excess of that reagent.

Eau de Cologne.—(1.) Take 6 pints of rectified spirit of wine, $\frac{3}{4}$ of a pound of spirit of rosemary, 1 pound 2 ounces of eau de melisse des carmes, $1\frac{1}{2}$ ounce of essence of bergamot, $\frac{3}{4}$ drachm of essence of neroli, 1 drachm of essence of cedrat, $1\frac{1}{2}$ drachm of essence of lemon, and 1 drachm of oil of rosemary. Mix and distil in a water-bath. Keep in a cool place. (2.) Take 1 pound of alcohol, 1 drachm each of oil of bergamot, oil of orange-peel, oil of rosemary, and bruised cardamom seeds, and 1 pound of orange-flower-water. Distil 1 pint, by means of a water-bath. (3.) Take of the essence of bergamot, lemon-peel, lavender, and orange-flower, of each 1 ounce; essence of cinnamon, $\frac{1}{2}$ ounce; spirit of rosemary, and of the spirituous water of melisse, of each 15 ounces; strong alcohol, $7\frac{1}{2}$ pints. Mix the whole together, and let the mixture stand for the space of a fortnight; after which introduce it into a glass retort, the body of which is immersed in boiling water contained in a vessel placed over a lamp, while the beak is introduced into a large glass receiver, well luted. Imitated, by pouring into a bottle containing 10 ounces of spirits of wine, 32° over

proof, 2 drachms each of essence of bergamot and oil of rosemary, 20 drops of essence of lemon, and 12 drops of essence of neroli, or oil of orange. Cork the bottle well, and seal it with wax, shake it frequently for the six following days, and then add 1 ounce of balm-water. Cork, seal, and shake it again for three or four days, when it will be ready. Care must be taken to mix the ingredients in this order, for if the balm-water is added before the others the perfume will be spoiled.

MITHRIDATE, OR THERIACUM, an ancient, most absurd, and complicated preparation, is said to have been *discovered!* by Democrates, and to be an antidote to all poisons. The formula of Democrates is as follows:—Take 24 drachms of cinnamon, 10 drachms each of Indian spikenard, ginger, saffron, seeds of shepherd's purse, frankincense, and Chia turpentine, 1 ounce each of zedoary, mace, long pepper, juice of hypocistus, storax, opoponax, galbanum, opobalsamum, and castor, 7 drachms each of scordium, cubebs, white pepper, carrot-seed, and bdellium, 5 drachms each of Celtic nard, gentian, dittany of Crete, red roses, wild parsley-seed, cardamoms, sweet fennel-seeds, gum arabic, and strained opium, dissolved in wine, 3 drachms each of aromatic reed, valerian-root, sagapenum, and anise-seeds, 2½ ounces each of catechu, St. John's wort, and skinks; dry these, powder and make into an electuary, with three times its weight of honey. This preparation, is supposed to have been taken by Mithridates as an antidote to poison. According to some accounts viper's flesh was also an ingredient which rendered it an antidote to the bite of snakes as well as to internal poisons.

LAVENDER-WATER is best manufactured on the large scale. Take 30 gallons of the best spirits of wine, pour it into a copper still, placed in a hot-water-bath, over a clear but steady fire. Put to it 6 pounds of the largest and freshest lavender flowers picked from the stalks and leaves, but not any water; lute the joinings carefully, digest twenty-four hours, and then with a gentle fire draw off 25 gallons, and immediately pour this into a copper vessel. When it has stood ten days add 10 ounces of the best English oil of lavender, mix the whole well, and do not disturb it for a month. The older the better, if it be kept from too much heat or cold. What remains in the still will make an inferior sort. Lavender-water may be imitated by mixing a gallon of proof spirits with 1¼ ounce of the best English oil of lavender: if more oil is used it will render the spirit white or turbid. When properly mixed let it be put into glass bottles, well stopped, which are to be shaken before using. Or to 1 pound of rectified spirit put 2 ounces each of oil of lavender and of bergamot, and 4 cloves; shake well, and add 2 ounces of distilled water. Oil of lavender may be adulterated with the second sort distilled from the residue of the flowers in the still, and with spirits of wine.

TO MAKE SILKWORM GUT.—Steep silkworms, when just ready to spin, in strong vinegar for twelve hours in warm weather, or two or three in cold; then take them out, break them in half, stretch them out as far as possible on a board, furnished with slits or pegs to hold them, and dry them in the sun. Used by anglers. The worms may be known to be going to spin by refusing food, and by having a fine silken thread hanging from their mouths.

INCORRODIBLE INK.—Prep. I.: *a.* Take powdered copal 25 grains; oil of lavender 200 grains; dissolve by a gentle heat, add lampblack 3 grains, indigo 1 grain.—*b.* Powdered copal 1 part; oil of lavender 7 parts; vermilion 4 parts; as last. II. Take genuine asphaltum 1 part; oil of turpentine 4 parts; dissolve, and add lampblack or blacklead to bring it to a proper consistence. Resists the action of iodine, chlorine, alkalis, and acids. III. Asphaltum dissolved in amber varnish and oil of turpentine, and coloured with lampblack.

IODATE OF POTASH.—Prep. I.: Neutralize a hot solution of potassa with iodine, evaporate to dryness by a gentle heat, powder, and digest in alcohol, to dissolve out the iodide of potassium, then dissolve the residue in hot water and crystallize. II.: (M. Henry, jun.) Iodide of potassium 2 parts; chlorate of potassa 3 parts; fuse the iodide of potassium in a large Hessian crucible; remove it from the fire, and add, while still fluid, successive portions of the powdered chlorate of potassa, stirring well after each addition. When the matter ceases to froth up, cool, powder, and digest in tepid water to dissolve out the chloride of potassium, when the residue may be dissolved in hot water and crystallized. A mixture of iodate of potash and starch is a most delicate test for sulphurous acid.

THE EMPLOYMENT OF NITRATE OF POTASH IN AGRICULTURE.—The agency of nitrate of potash upon plants presents contradictions in the observations which have been published. It is pretended, on the one hand, that gardeners employ this agent with success to accelerate the vegetation of onions. And Trommsdorf has asserted that of two branches of peppermint, one plunged into pure water, and the other into water containing nitrate of potash, the former absorbed only 145 grains of the solution, whilst the latter absorbed 348. Barton, on the contrary, has asserted that a few grains of nitre had sufficed in his experiments to kill a kalmia. M. Vogel plunged an individual of Matricaria parthenium in a solution containing one-thirtieth part of its weight of nitrate of potash. It began to fade after the lapse of two days, and died at the expiration of the fourth; whilst another individual of the same species being plunged in a solution of sulphate of lime preserved its freshness for a week. The leaves of those plants which had rested for some days in a solution of nitrate of potash became covered over with little white crystals, which were found to be those of nitrate of potash. These contradictions as to the action of nitrate of potash depend upon the influence of the size of dose, and the length of time during which the experiments were protracted.

ESSENCE OF ESHALLOTS.—Peel 2 ounces of eshallots, pound them in a mortar, and infuse in a pint of sherry for ten days; pour this liquor on 3 ounces more of pounded eshallots, and again macerate for ten days. It is excellent for making mustard, flavouring soups, &c.

ESSENCE OF GINGER.—Take 6 ounces of sliced ginger, 12 ounes of alcohol, 4 ounces each of refined sugar and of water, 2 drachms cardamom seeds bruised; macerate for three weeks and filter.

PLATE POWDER TO CLEAN PLATE BY BOILING.—Take bitartrate of potash, common salt, and alum, of each equal parts. Mix well. Add a little of this powder to the water in which plate is boiled.

TO CORRESPONDENTS.

"Mr. James Snell."—Madder is generally used as a dye; sometimes, however, for medical purposes. It is astringent, and supposed to be emmenagogue and deobstruent. The powder has been given in doses of half a drachm to one drachm, or more, with sulphate of potash, four times a day, or in form of decoction. It tinges the urine blood-red, and also imparts its colour to the bones. It is apparently a remedy of little power, though it has been prescribed in jaundice, ameuorrhœa, rickets, &c., and in the atrophy of infants.

"A Tobacconist, Truro."—Tobacco is extensively adulterated with dried dock-leaves, browned, as is the case with tobacco itself, by sulphate of iron and cascarilla, for the purpose of giving it flavour. Nitrate of potash is added to make tobacco, in form of cigars, kindle readily; but it is injurious to the lungs. Other metallic substances are often found mixed with tobacco, such as antimony, bichloride of mercury, copper, lead, &c., as well as alum, sugar, treacle, red ochre, liquorice, hellebore. Tobacco in the form of snuff is adulterated still more largely.

"Mr. John Barrow."—Ipecacuanha is adulterated before importation by being mixed with roots of several sorts of violets, ionidium, &c. The genuine sort is in short wrinkled pieces of a grey or brown colour. The larger and browner the pieces the better. When white and smooth it is very weak. This latter and other roots are sold in powder by fraudulent druggists mixed with potassio-tartrate of antimony. This fraud can only be detected by analysis.

"Mr. J. Allen."—Sandarach is obtained principally from the Thuya articulata, a native of Barbary. It exudes spontaneously, and is usually found in the state of small round bars of a brown colour, and semitransparent; in appearance not unlike mastich, but rather more transparent and brittle. When charred mastich softens, which sandarach does not, but crumbles to powder. Unlike common resin, it does not dissolve in tallow or oil. Unverdorben, the great authority on resins in general, has subjected sandarach to a minute chemical investigation.

"A Manufacturer."—Paraffine was discovered by Reichenbach, and by him made known in 1830. Its name is derived from parum and affinis, on account of the little or no affinity which it exhibits for other substances. Chlorine exerts no action upon it, neither is it acted upon or altered by sulphuric, hydrochloric, nitric, acetic, oxalic, or tartaric acids, nor by solutions of ammonia, potash, lime, baryta, strontia, carbonated alkalis, hydrate of lime, or potassium, even when in a state of fusion. Red oxide of lead and binoxide of manganese are equally without action upon it. When melted with sulphur, phosphorus, or selenium, it dissolves a small portion of these bodies, but in other respects remains unaltered.

"Mr. R. Hooper."—Gentian is the root of the Gentiana lutea, a native of the mountainous parts of France, also of Switzerland and Hungary. It is said to have been named after Gentius, a king of Illyria.

"A Country Bookseller."—Paper such as we use at present was unknown to the ancients. Most probably we derived its use from the Arabians, who, it is believed, were acquainted with paper made from cotton rags as early as the year 704. The art, however, of paper manufacture was known and practised at a much earlier date in China. Cotton paper was employed in Europe as early as the ninth century.

"Mr. Burnston."—It is a deposition of carbonate of lime around a nucleus, and apparently from a solution of the bicarbonate.

"J. P. (Dec. 29)."—The tinned paper may be obtained at Mr. Penn's manufactory, Coventry-road, Birmingham.

"A Correspondent at Leeds," who desires us to send him No. 86, vol. 3, of the *Pharmaceutical Times*, and the Conspectus, is informed that both are out of print.

"Mr. L. Dean."—Oxalic acid is procured by dissolving 1 part of sugar in 4 parts of nitric acid, and slowly distilling about 1 part of the whole. The crystals are afterwards obtained by evaporating the liquor that remains in the retort. The crystals closely resemble Epsom salts in appearance; hence the frequent mistakes which arise. An unfailing antidote, if given in time, is chalk mixed with milk or water.

"A Copperplate Engraver."—Frankfort black is said to be made from the lees of wine, after washing and burning out the tartar. It may also be made from vine twigs and tendrils, and of inferior quality from boxwood or ebony charcoal levigated. It is chiefly used in copperplate printing, being richer in tint than ivoryblack, and deepening on exposure to light.

"A Father."—There is no chemical antidote for arsenic whatever on which we place perfect reliance; the bydrated peroxide of iron is undoubtedly the best; but in actual practice it is next to useless, inasmuch as it ought to be prepared when wanted, as its qualities are impaired by keeping. In a case of poisoning by arsenic we would depend on emetics and the stomach-pump, discarding all reliance on chemical antidotes whatever.

"Mr. H. Langley."—Essence of coltsfoot contains no portion of coltsfoot whatever, but is composed of equal parts of tincture of benzoin and balsam of Tolu, with 2 parts of rectified spirit. It is a dangerous medicine for coughs, for which it is employed, being stimulant, and therefore irritating.

"Mr. Henry Nelson."—The elixir of Garus is thus made:—Take 328 parts of aloes, 64 parts of myrrh, 32 parts of saffron, 16 parts each of cinnamon, cloves, and nutmeg, 1,000 parts of alcohol, 5,000 parts of distilled orange-flower-water. Mix and digest for two days, and distil 4,000 parts in a water-bath. Add 5,000 parts of syrup of capillaire.

"Mr. Charles Rogers" suggests that we should give in the forthcoming number of the *Chemical Times* a short article on the localities where gold had been found anterior to the Californian discovery. Has our correspondent not had enough of gold? If the metal were really not good for making evaporating-dishes, saucepans, and crucibles, the civilized world would be likely soon to hate the sight of it.

"Mr. Stepheu Bowden" is informed that his valuable specimen of the winter's bark-tree has been safely received and deposited, according to instructions, in the conservatory, where it will have every care bestowed upon it.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, in the parish of St. Clement Danes, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—January 13, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLI.

(LECTURE LXIX.)

The medicinal substances containing extractive matters may be distributed under the following six heads:—

1. Bitter extractive.
2. Purgative extractive.
3. Diophoretic, diuretic, anthelmintic, depurative, &c. &c., extractives.
4. Extractive in conjunction with essential oil.
5. Bitter extractive in conjunction with essential oil.
6. Extractive in conjunction with resin and essential oil.

SECTION I.—BITTER EXTRACTIVE.

A.—BITTER BARK.

BARK OF THE HOLM OR HOLLYOAK.

(Ilex aquifolium.)

This bark is considered an excellent febrifuge; it is usually administered in powder, in doses of 4 to 8 grammes.

M. Deleschamps has extracted from the bark of the hollyoak a yellow, brownish, crystalline substance, soluble in water and in alcohol, insoluble in ether.

BARK OF THE ASH-TREE.

(Fraxinus excelsior.)

Febrifuge, but effective only in large doses (20 to 30 grammes, and more).

Keller has extracted from this bark a peculiar principle, which crystallizes in fine, hexagonal prisms, is sparingly soluble in ether, but dissolves readily in alcohol and in water; the name "fraxinin" has been given to this principle.

BARK OF THE (INDIAN) CHESNUT-TREE.

(Æsculus hypocastanum.)

This bark enjoyed formerly considerable reputation as a febrifuge; it would appear, however, that, except when given in very large doses, its curative effects are exceedingly doubtful.

BARK AND LEAVES OF THE OLIVE-TREE.

(Olea europæa.)

Landerer has extracted from the leaves of the olive-trce a crystallizable, colourless, bitter principle, insoluble in water, but readily soluble in acids; to this principle he has given the name "olivin." He treats the leaves of the olive-tree with acidulate dwater, concentrates the extractive fluid obtained, and precipitates the concentrated fluid with ammonia; he then redissolves the precipitate in an acid, purifies with carbon, and reprecipitates.

BARK OF THE PHYLLYREA.

(Phyllyrea latifolia.)

This bark is considered to possess febrifuge properties.

Carboniezi has extracted from it a bitter, inodorous principle, which crystallizes in nacreous scales, and is sparingly soluble in cold water, and almost insoluble in ether, but dissolves readily enough in boiling water, and with greater facility still in alcohol. The name phyllyreïn has been given to this principle.

BARK OF THE SIMARUBA.

(Simaruba amara.)

Infusions and decoctions of the bark and the root of simaruba are frequently given in cases of chronic dysentery; the usual proportion is 16 to 20 grammes of the root to one quart of water. The decoction is much less bitter and efficacious than the infusion.

Morin has analyzed the bark of the simaruba. He found in it:—

A resinous matter,
A little volatile oil,
Quassia,
Ulmin,
Several salts.

ANGUSTURA VERA.

(From Galipea officinalis.)

According to Husban's analysis this bark contains:—

Cusparin,
Gum,
Extractive,
Resin,
Volatile oil.

Brandes found in the bark of angustura vera a vegeto-alkali; Thompson a principle analogous to cinchonin. Since then M. Saladin found that the alcoholic solution of the aqueous extract of angustura yields, upon spontaneous evaporation, tetrahedrin crystrals of cusparin. These crystals are neutral; they fuse readily, losing 23 per cent. of their weight. They are sparingly soluble in water (cold water dissolves one half per cent. of them, boiling water one per cent). They are more readily soluble in alcohol, in the acids, and in concentrated alkalis. Gallnuts precipitate cusparin from its solutions.

POWDER OF ANGUSTURA.

Reduce the bark to powder, without leaving any residue.

This powder is recommended as a febrifuge, in doses of 4 to 16 grammes. It is also given sometimes in cases of dysentery, in doses of ½ to 1 gramme.

EXTRACT OF ANGUSTURA.

Lixiviate the powder of angustura with water of 68° Fahrenheit, and evaporate the solution to the consistence of an extract.

From 100 parts of bark I obtained 28 parts of extract; one part of the latter is, accordingly, equivalent to 3½ parts of the bark.

WILLOW BARK.

The bark of the willows and poplars possesses febrifuge properties. M. Leroux discovered in the bark of the willow (salix helix) a bitter, crystallizable principle, to which he gave the name salicin. This principle has since been found to exist in the following varieties of the willow and of the poplar:—

Salix Alba,
" Hastata,
" Præcox,
" Monandra,
" Incana,
" Vitellina,
" Fissa,
" Amygdalina,
" Helix,
Populus Tremula,
" Tremuloïdes,
" Græca,
" Alba.

It is highly probable that salicin exists in a great many other species; yet all attempts to extract it from some of them have hitherto failed. This may be owing, however, to the presence of other principles impeding its extraction, as would appear from the fact that some chemists have by peculiar processes succeeded in extracting salicin from some varieties of willow which, in other hands, had refused to yield any.

The barks of the willows and poplars are bitter. They contain, besides salicin:—

Corticin,
Tannin,
Pectic acid,
Gum,
A fatty matter, and undoubtedly, also, some extractive colouring matter.

Corticin was discovered by M. Braconnot. This principle exists in almost all ligneous barks. It has the greatest analogy with the red principle of cinchonia, which seems, in fact, simply a variety of corticin, modified, perhaps, by the presence of some extraneous colouring matter.

Corticin is an inodorous and insipid substance; it has a pale red colour. It is very sparingly soluble in water; the aqueous solution exhibits a reddish-yellow tint. It is readily soluble in alcohol, and the solntion is not precipitated by water. It is also very readily soluble in concentrated acetic acid, but from this solution water precipitates it.

It dissolves completely in the alkalis, without, however, saturating them. The alkaline carbonates exercise no action upon it. If corticin is boiled with lime-water or baryta-water an insoluble compound is formed, which the caustic alkalis fail to dissolve. Sulphuric acid dissolves corticin unaltered; from this solution it is precipitated by many of the metallic salts.

M. Braconnot has extracted from the bark and leaves of several species of poplar a peculiar principle, to which he has given the name populin. This principle is greatly analogous to salicin, from which it differs, however, in some essential points. Van den Gheyn recommends the following simple process for its production:—

Boil the bark of the root of the aspen (Populus tremula) in water, and evaporate the decoction at a gentle heat, when the populin will crystallize; purify the crystals by solution in alcohol, and digest with animal charcoal.

Pure populin is a snowy-white substance; it has a sweet, liquorice-like taste. It requires 2,000 times its weight of cold, and 70 times its weight of boiling, water for solution. It is more readily soluble in alcohol. On distillation it yields an oily substance, which after a time deposits benzoic acid. It has the following characters in common with salicin:—The mineral acids transform both principles into a white resinous powder; dilute sulphuric acid converts them into grape-sugar, and a peculiar matter; concentrated sulphuric acid changes them into rutilin; hot nitric acid converts them into carbazotic acid.

Salicin.—According to Berzelius, the best process to prepare salicin is that suggested by Nees von Eisenbeck, viz., to boil willow bark (that of salix helix answers best) in water, add to the solution hydrate of lime (which precipitates the tannin), filter the liquid, evaporate the filtrate to the consistence of syrup, and add a sufficiency of alcohol to effect the removal of the gums. The solution filtered off from the precipitated gum, yields upon evaporation impure crystals of salicine; the mother liquor yields upon further evaporation a fresh quantity of salicine; an additional quantity of salicine may then be obtained by continuing to evaporate the last mother liquor, after having previously added to it a certain amount of subacetate of lead.

The impure crystals of salicine obtained in the three operations are dissolved in boiling water, and digested with animal charcoal. The solution is filtered boiling, and the filtrate left to crystallize.

Merck advises to boil the decoction of the willow bark with litharge until it is completely decolorated; by this means the gum, tannin, and extractive matters are removed, the salicine remaining in solution, together with the oxide of lead; the latter is then precipitated with sulphuric acid, and the small excess of the acid subsequently removed by means of sulphuret of barium; the liquid is filtered off the precipitate, and the filtrate evaporated, when the pure salicine will be deposited in small and delicate rectangular prisms or needles of white colour, presenting sometimes a nacreous aspect.

Salicine is composed of 26 equivalents of carbon, 9 of hydrogen, and 14 of oxygen; it contains besides 6 equivalents of water, which secede from it upon its combination with oxide of lead.

Pure salicine is inodorous; it has a very bitter taste. It fuses at a few degrees above 212° Fahr.

without losing water; upon cooling the fused mass reassumes the crystalline state.

Water of 63.6 Fahr. dissolves about 6 per cent. of salicine. In boiling water salicine dissolves in all proportions; it is almost equally soluble in alcohol, but insoluble in ether and in the volatile oils. It dissolves in hydrochloric acid unaltered, so that it may be reobtained from the hydrochloric solution by evaporation. It is more readily soluble in nitric acid than in water: cold nitric acid dissolves it unaltered, but hot nitric acid converts it into benzoic acid and carbazotic acid. Synaptase changes salicine into grape sugar and saligenin (C_{14} H_8 O_4).

From its solution in dilute sulphuric acid salicine crystallizes in large tetrahedric prisms. All dilute acids decompose salicine into grape sugar, and a species of resinous powder (saliretine).

The solution of salicine in cold concentrated sulphuric acid looks red, and upon dilution with water deposits a red sediment (Braconnot's rutilin), which is insoluble in alcohol. Acids deepen the red colour of rutilin; alkalis change it to a dark violet, which turns red again upon addition of an acid.

Acetic acid dissolves salicine; the acetic solution turns milky upon the addition of water. Acetate of lead fails to precipitate salicine from its solutions. Neither gallnuts nor the salts of platinum and silver exercise the slightest action upon salicine; the salts of mercury hardly trouble its solution.

On distillation with sulphuric acid and bichromate of potass, salicine yields formic acid, carbonic acid, and volatile oil (hydruret of salycile).

Salicine retains usually the aromatic flovour of the willows which have supplied it. MM. Herberger and Büchner regard this aromatic salicine as a saline compound of salicine with an odorous volatile acid.

Salicine is used in medicine as a febrifuge in doses of 1 to 1½ gramme.

Some physicians prefer the extract of the willow bark to salicine, maintaining that the matters which are associated in the extract with the salicine render the latter more efficacious.

The extract of willow bark is prepared by lixiviating the pounded bark with water of 68° Fahr.

BARK OF THE PLUM-TREE, APPLE-TREE, PEAR-TREE, &c. &c.

The bark of a great many of the Rosaceæ, of Padus mahaleb, for instance, Padus avium, Prunus virginiana, Prunus cocumiglia, is astringent, and used medicinally as such or as a febrifuge; the poisonous volatile principle, which is found in the leaves and seeds of many of the trees of this tribe, exists often also in their bark.

Komminck and Sterns have extracted from the bark of the plum-tree, pear-tree, apple-tree, and cherry-tree, a crystalline principle, to which they have given the name Phloridzin. This principle has been carefully studied by M. Stass. It has a bitter, astringent taste; it crystallizes in prisms and needles of silky lustre. It is composed of 32 equivalents of carbon, 15 equivalents of hydrogen, and 12 equivalents of oxygen + 6 equivalents of water. Its composition may accordingly be represented by the formula for salicine + 2 equivalents of oxygen.

Phloridzin is almost insoluble in cold water; boiling water dissolves it in all proportions. It is exceedingly soluble in alcohol, insoluble in ether. Dilute sulphuric acid converts phloridzin into grape sugar and phloretin, a crystallizable substance which is almost insoluble in water. Phloridzin, when placed in contact with the air and with ammonia, absorbs oxygen and ammonia, and is converted into a red substance, called phlorizein.

B.—BITTER ROOTS.

The following are the bitter roots which are most frequently used in medicine:—

The root of Pareira brava,
" Columbo,
" Quassia amara,
" Gentian.

PAREIRA BRAVA.

The root and sometimes the stem of several species of plants belonging to the genus Cissampelos (more particularly cissampelos pareira, guyaquilensis, caapeba, mauritiana, microcarpa) are used in medicine under the name of pareira brava.

The abuta rufescens of Guayana, and the roots and wood of a great many plants of the cocculus and menispermum tribes, are used in America and in the Indies, being considered to possess medicinal properties analogous to those of the plants of the cissampelos family.

Pareira brava enjoyed formerly considerable reputation as a febrifuge and efficacious remedy in diseases of the liver; it was also often resorted to in diseases of the urinary organs, and, at one time, considered an excellent lithontriptic. At present, however, it is only rarely had recourse to in Europe, though it holds still its ground in India and America.

M. Feneulle found in pareira brava:—

A soft resin,
A yellow bitter principle,
A brown principle,
Starch,
An animalized matter,
Several salts.

Wiggers has extracted from it a peculiar vegeto-alkali, to which he has given the name *Cissampelin*, or *Pelosin*.

This vegeto-alkali is yellowish and transparent. It has a bitter sweetish taste; it is insoluble in water, with which it may, however, enter into combination; from this combination the pelosin secedes again at 212° Fahrenheit. Pelosin restores the blue colour to reddened litmus paper, and combines with acids; of the salts which it forms with the latter, the hydrochlorate alone has been obtained in the crystalline state.

Wiggers recommends the following process for the preparation of pelosin:—

Extract the root of pareira brava with water acidulated with sulphuric acid; precipitate the solution obtained with carbonate of soda; purify the precipitate by solution in ether.

INFUSION OF DECOCTION OF PAREIRA.

Take of Pareira brava-root, 30 grammes.
Water, 1,000 grammes.

Infuse, or boil.

The process of infusion is preferable to that of decoction: the infusion of pareira is limpid and very bitter; whereas the decoction looks turbid and has a much less decidedly bitter taste.

The infusion is still used as a lithontriptic, and also as a diuretic; but hardly ever in Europe.

EXTRACT OF PAREIRA.

Extract the root with water or with alcohol; with either of these vehicles pareira will yield the eighth part of its own weight of extract.

ALCOHOLIC TINCTURE OF PAREIRA.

Take of Pareira brava, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Macerate for fifteen days; filter.

The essence of pareira brava is prepared in the same way, with 1 part of pareira to 2 parts of alcohol of 80 C.

COLUMBO-ROOT.

The root of columbo is furnished by the Cocculus palmatus.

According to Planche's analysis, columbo-root is composed of:—

Starch (33 per cent. of the weight of the root),
Animalized matter,
A yellow, bitter matter,
A little volatile oil,
Several salts.

The yellow, bitter matter is soluble in water and in alcohol. Wittstock obtained from it a colouring matter and a crystalline substanee, to which latter he gave the name *columbin*.

Columbin is colourless and inodorous; it crystallizes in rhomboïdal prisms; it has a very bitter taste; it fuses like wax: it contains no nitrogen, and belongs to the class of neutral substances; at the common temperature it is only very sparingly soluble in water, alcohol, and ether; boiling alcohol of 0.835 density dissolves only a small proportion of it. It is more readily soluble in alkaline liquors, but acetic acid of 1.04 density is the best agent for its solution.

Columbin is obtained by the following process:—

Treat the root with alcohol of 90 C. (36° Cartier); distil off two thirds of the liquid. Purify the crystals of columbine which are deposited by resolution in alcohol and digestion with animal charcoal.

POWDER OF COLUMBO-ROOT.

Columbo-root is very friable, and should be pulverized without leaving any residue.

Powder of columbo is used as a tonic, in doses of 3 to 4 or 5 centigrammes.

HYDROLATE OF COLUMBO.

The products obtained by the action of water upon columbo-root differ according to the temperature at which the operation is conducted.

By simple maceration with water we obtain a solution which contains the odorous principle, the animal matter, and the yellow bitter matter of the root. By infusion we obtain, besides these principles, a little starch. Decoction dissolves the whole of the starch.

As a tonic the products of the maceration and infusion are unquestionably preferable to that of decoction; but the latter will answer best in cases of dysentery.

Although columbin is but sparingly soluble in water, yet the bitter matter which yields this principle dissolves readily enough in that menstruum; the solution of the columbin is here facilitated by the presence of the colouring matter, and, perhaps, by the combination of the latter with the columbin.

ALCOHOLIC TINCTURE OF COLUMBO.

Take of Columbo-root, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Macerate for fifteen days; strain, squeeze out the whole of the liquid from the root, and filter.

Alcohol of 56 C. dissolves the bitter principle of columbo exceedingly well; a portion of the animalized matter is also dissolved, owing to the presence and influence of the colouring principle.

One part of tincture represents somewhat less than one fifth of its weight of columbo-root.

EXTRACT OF COLUMBO.

Take of Columbo-root, any quantity.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Pound the root, and proceed by displacement; distil the liquors to drive off the alcohol, and evaporate the residue at the heat of the water-bath.

The alcoholic extract of columbo is preferable to the aqueous extract, which latter contains, besides the bitter and colouring principles, starch, and is accordingly much more liable to alteration.

I have obtained 22 parts of alcoholic extract from 100 parts of columbo-root.

QUASSIA.

Quassia-wood is supplied by Quassia amara. It owes its medicinal properties to a peculiar principle of exceeding bitterness, to which Thomson has given the name quassin: this principle is soluble in water and in alcohol. Wiggers extracted from it a crystalline, inodorous, colourless, exceedingly bitter matter, sparingly soluble in water and in ether, but very readily so in alcohol. Gallnuts precipitate it from its solutions.

It fuses like the resins. In composition it is analogous to the bitter principle of columbo-root. It is composed of—

C_{20} H_{12} O_6.

Quassin is prepared by the following process:—

Evaporate decoction of quassia to three fourths;

add hydrated lime to precipitate the pectin, and evaporate to dryness. Dissolve the residue in alcohol of 90 C., and evaporate again. Redissolve with ether mixed with a small proportion of absolute alcohol, and evaporate the ethereal solution over a little water. The quassin crystallizes in white opaque prisms.

Quassia amara is usually administered in form of extract, ptisan, or vinous tincture. It enjoys some reputation as a tonic and febrifuge.

PTISAN OF QUASSIA.

Take of Quassia-wood (rasped), 8 grammes.
Water, 1,000 grammes.

Infuse for two hours, and strain.

Infusion of quassia is preferable to the decoction: it is much bitterer than the latter.

EXTRACT OF QUASSIA.

Take of Quassia amara, any quantity.
Water of 68° F., a sufficiency.

Reduce the wood to powder, and moisten this with half its own weight of water. At the end of one or two hours heap the powder closely in a displacement apparatus, and lixiviate: evaporate the liquors obtained to the consistence of an extract.

I obtained from 100 parts of quassia 7 $\frac{3}{10}$ ths of extract. One part of extract represents 14 parts of quassia.

QUASSIA WINE.

Take of Quassia amara,
Alcohol of 56 C. (21° Cartier), of each 1 part.
White wine, 15 parts.

F.S.A.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

RESEARCHES ON PROTEINE.

By Prof. J. G. MULDER.

[*Continued from page* 131.]

The albumen from the serum of the blood furnishes on analysis a result identical with that of the preceding. This result is exhibited in the following expression:—

$C_{36}\ H_{27}\ N_4\ O_{12} = C_{36}\ H_{25}\ N_4\ O_{10} + 2HO.$

A proteine which contains 2.24 per cent. of sulphur is represented by $5C_{36}\ H_{27}\ N_4\ O_{12} + S_2\ O_2$, while albumen in which sulphur only is admitted into the formula may be expressed by $5C_{36}\ H_{26}\ N_4\ O_{11} + 2SNH_2$. The formula of such albumen would then be $20(C_{36}\ H_{26}\ N_4\ O_{11} + 8SNH_2 + PNH_2$.

It consists of Sulphamide..... 3.2
Phosphamide 0.6
Hydrate of proteine . 96.2

in 100 parts.

ON THE CHANGE WHICH ALBUMEN UNDERGOES WHEN ACTED ON BY POTASH AND CHLORINE.

Albumen, it is well known, when treated with a solution of potash, disengages ammonia at a high temperature. Chlorine, passed into albumen, precipitates all the albumen, and the precipitate contains all the sulphur, but in a form in which it will not act on silver. The liquid, it is found, contains chloride of ammonium. Ammonia is, therefore, the only substance which forms and separates from the compound. The action of potash and chlorine is not difficult to explain. We assume the existence of sulphamide in albumen, ammonia is set free by the chlorine, the sulphur meanwhile remaining unchanged in amount, and only assuming the form of an oxyacid, $S_2\ O_2$. The sulphamide is thus set free by the chlorine, and from $2SNH_2 + 2HO$ is formed $2NH_3 + S_2\ O_2$. Potash has a double action on albumen: under the influence of KO and HO, SNH_2 yields $2H_3\ N + S_2\ O_2$, the ammonia of which escapes, part of the latter combining with the potash and a part with the precipitate thrown down by acetic acid, the hyposulphites being decomposed by heat. KO, $S_2\ O_2$ form KS.

As to the presence of sulphamide in albumen, it is not necessary to prove the separate existence of this group. As to the inquiry, does the sulphur in the proteine which does not act upon silver exist as $S_2\ O_2$ or as SO_2 or SO_3? we may reply that there is no reason whatever for regarding it as SO_3; but it is certainly an oxide of sulphur, and all that has been discovered hitherto leads us to believe it is $S_2\ O_2$, and not SO_2.

Further, with regard to the phosphamide, we may notice that the phosphorus in albumen exists in two different states. It is partially united with lime, as PO_5, and separable from it by hydrochloric acid; and part also is contained in another form, for the amount of phosphoric acid obtained by decomposition with nitric acid is always larger than that obtained by means of hydrochloric acid. It is proved that this phosphorus exists in the state of phosphamide by the evolution of phosphuretted hydrogen, when proteine is precipitated from the potash solution with acetic acid. We shall recur to this subject when treating of legumine, a substance which contains the largest amount of phosphorus.

Action of Sulphurous Acid on Albumen.—The effect of this acid, like that of potash, atmospheric air, and chlorine, is to render the albumen no longer capable of acting upon salts of lead and silver. Albumen obtained from an egg when treated in an alkaline solution with sulphurous acid yielded a precipitate containing 2.22 per cent. of sulphur; 0.6 of sulphur had had, therefore, been absorbed by the precipitate by means of the sulphurous acid.

Speedy Method of obtaining Proteine containing $S_2\ O_2$.—Dissolve albumen in caustic potash, keep it from three to four hours in the water-bath until it acts powerfully on salts of lead, then pass sulphurous acid through the heated mass until proteine is precipitated. From the liquid filtered from this acetic acid precipitate, proteine, which contains $S_2\ O_2$ in the proportion of exactly 2.4 per cent. This proteine is perfectly white, possesses all the qualities of that described nine years ago, and agrees most perfectly with albumen.

In the ordinary way of preparing proteine with $S_2\ O_2$ from albumen, a substance is at the same time precipitated, which dissolves in alcohol; it is yielded most abundantly by caseine. The substance dissolves in boiling alcohol, and is almost entirely separated on cooling. When this substance obtained from albuminous proteine is boiled in an alkaline solution, a body is left after evaporation, which, after it has been treated with ether to free it from fat, presents all the properties of proteine. Nitric acid converts this body into exanthoproteic acid, and with muriatic acid it furnishes the violet substances noticed by Bourdois and Caventou.

The Liquid from which Proteine has been separated in treating Albumen with a Hot Solution of Potash.—Various substances are contained in this liquid. First, an organic matter soluble in water, possessing the general properties of proteine, but partially deficient in $S_2\ O_2$. When chlorine is passed into the liquid, the same organic group is obtained as exists in the precipitate with acetic acid. When the liquid acidulated with acetic acid is saturated with potash, and acetate of copper is added, a slight precipitate is yielded, and the liquid filtered from it gives no precipitate with potash; it remains perfectly clear and becomes violet, as when grape sugar is treated with a copper salt and potash.

Salts of Proteine and Proteine Compounds.—The salts of proteine and those of albumen have almost identical properties. It was found in a large number of experiments that albumen acts a double part, and is both a base and an acid. The base is very small in quantity, and the preparation of pure albuminates of the metallic oxides is at present hardly to be thought of, as these are contaminated with several impurities. Proteine is not always free from fixed substances. I have not analyzed any of the salts in which albumen performs the functions of an acid, but, as an alkaline solution of proteine gives abundant precipitates with metallic salts, they may be prepared without much difficulty. The precipitates, however, contain only from 2 to 3 per cent. oxide. With the acids it is not so; albuminous proteine and albumen are capable of saturation in nearly the same degree.

Sulphate of Proteine and Sulphate of Albumen.—The amount of S_2O_2 in proteine and SNH_2 in albumen which remains in combination after the action of sulphuric acid is not fixed with precision; the atomic weight of proteine derived from albumen can, therefore, only be calculated from the combination with sulphuric acid. Sulphate of albumen was decomposed with muriatic acid; it gave—C 50.1; H 6.9; N 14.9; OS, 19.8; SO_3 8.3. Sulphate of crystalline gave 8.63 per cent. SO_3, and sulphate of caseine 8.45, giving the following formula:—$C_{36}\ H_{25}\ N_4\ O_{10} + (O\ 4SNH_3) + SO_3$, HO.

In order to prepare the combination of proteine with sulphuric acid, albuminous proteine containing 1.6 per cent. of S, as $S_2\ O_2$, was conveyed into pure SO_3, HO, and left in contact with it until the substance had perfectly dissolved into a thick yellowish liquid, which was then poured into a large quantity of water, when the sulphate of proteine precipitated as a white powder soluble in alkalis, and much resembling the sulphate of albumen in its reactions. Its composition may be expressed by the formula $2(C_{36}\ H_{27}\ N_4\ O_{12}) + SO_3$.

Muriates of Albumen and Proteine.—On the addition of muriatic acid or sulphuric acid to a solution of albumen, fibrine, or caseine, a combination of the organic substance with the acid employed is precipitated. The muriatic compound contained 3.6 to 3.8 per cent. ClH. Its composition is 5 equivs. albumen and 2 equivs. ClH.

Tannate of Albumen and Tannate of Proteine.—When tannic acid is dropped into a compound of proteine with $S_2\ O_2$ a tannate of proteine containing the whole amount of $S_2\ O_2$ is obtained; but, if tannic acid is mixed with albumen, tannate of albumen containing SNH_2 is obtained. Proteine combines with tannic acid in various proportions. Albumen, it has been found throughout, cannot be distinguished by its atomic weight, but only by its reactions.

Action of Chlorine on Albumen.—When a stream of chlorine is passed into a clear aqueous solution of albumen a flocculent precipitate is formed, not always identical, but varying with the length of time during which it is acted on by the chlorine. When the action is not too protracted it consists of a combination of albumen with chlorous acid, but after a longer reaction it consists of a combination of proteine with chlorous acid and hyposulphurous acid.

Chlorite of Albumen is expressed in the formula $C_{36}\ H_{25}\ N_4\ O_{10} + (O\ 4SNH_3) + ClO_2$, HO. One equiv. of water has been withdrawn, and its place taken by ClO_3.

Chlorite of Proteine is represented by the formula $C_{36}\ H_{25}\ N_4\ O_{10} + O\ 2S_2\ O_2 + 2ClO_3$. This substance loses half the ClO_3 at 212°.

Our knowledge of the proteine compounds has been advanced more by the action of chlorine upon them than by any other means. The organic group in which these bodies are contained always yields $C_{36}\ H_{25}\ N_4\ O_{10}$, and all the proteine contained in the primitive substance enters into the chlorine compound. Chlorine is, moreover, an excellent agent for decomposing sulphamide and phosphamide, and depriving all the proteine bodies of the reaction of sulphur.

Oxyproteine.—This name has hitherto been applied to a substance obtained as a second precipitate from the potash solutions of hair after the first has been precipitated and separated by filtration. A second precipitate is then obtained from the solution by acetic acid. It is insoluble in water, and has many properties in common with fibrine. The formula of this substance has been fixed by analysis, $C_{36}\ H_{27}\ N_4\ O_{12} + O$; it ought to be called protoxyproteine, and not binoxyproteine as heretofore. Vitelline is a combination of this oxyproteine with sulphamide, and contains sulphur in the form in which it acts upon silver. With regard to caseine, it

has been found to consist of an agglomeration of proteine compounds, and the same is true of crystalline; both must be the subjects of further examination.

Oxyproteine from Fibrine.—When purely white well-washed fibrine from bullock's blood is acted upon with a dilute solution of potash, and according to the process followed in the preparation of proteine, it yields a substance retaining the character of fibrine, and containing more oxygen than proteine. It is perfectly white, and possesses most of the characteristics of proteine; it does not react upon silver, and is insoluble in alcohol. Its formula is $C_{36} H_{27} N_4 O_{12} + O$.

Tritoxyproteine.—When ammonia is poured over chlorite of protcine it is dissolved, and nitrogen is disengaged. If the liquid is evaporated to dryness, and the residue exhausted with alcohol, chloride of ammonium and tritoxyproteine are obtained. A method of obtaining this substance in a state of greater purity is to boil albumen, fibrine, &c., with water, and exhaust the residue obtained on evaporation with alcohol. In the preparation from the chlorite of proteine by means of ammonia $C_{36} H_{25} N_4 O_{10} + ClO_3$ is formed from $C_{36} H_{25} N_4 O_{10}$; on solution with ammonia the product furnishes chloride of ammonium and $C_{36} H_{25} N_4 O_{13}$, and nitrogen is disengaged. A small quantity of hydruret of benzoyle is always evolved in the preparation of this body. This point deserves to be more closely examined, as it may enable us to ascertain more completely the constitution of proteine.

Horny Tissues.—Hair, horn, and whalebone, which were at first classed with the proteine compounds, incline us to think that albuminous substances generally consist of a combination of sulphamide with proteine. Laer, Tilanus, and Kerchoff have proved that they all yield oxyproteine on treatment with a hot solution of potash, and some of them furnish proteine itself. At present I am unable to state positively which of these bodies yield proteine and which oxyproteine. Small quantities of other matters are met with in the cellular tissues of these bodies, modifying the condition of the cell-wall and disturbing the course of analysis. Whalebone contains in 100 parts 7.2 parts sulphamide; hair, 100 parts, 10 parts sulphamide; and cow's horn, 100 parts, 6.8 parts sulphamide.

Tortoiseshell is a mixed substance, and does not belong to the simple protcine bodies. Skin is allied to horn, but I had not a sufficient quantity at my command to enable me to determine the sulphur.

The following conclusions have been the result of my most recent investigation of this subject:—

1. All the albuminous substances which have hitherto been examined may be regarded as combinations of $C_{36} H_{25} N_4 O_{10}$ with sulphamide and phosphamide in various proportions.

2. Other substances closely related to the above mentioned are $C_{36} H_{25} N_4 O_4$, and $C_{36} H_{25} N_4 O_{13}$, and may be called oxyproteine.

3. Sulphur is not an essential element of the precipitate produced from a solution of albuminous substances by acetic acid: its amount is fluctuating in warm potash, and it exists in the form of $S_2 O_2$.—*Journ. für Prakt Chem.*, vol. xliv., p. 488.

ON THE PRESENCE OF CARBONIC ACID IN URINE AND MILK.

By R. F. MARCHAND.

That carbonic acid frequently exists in urine in a free state was long ago announced by Proust. It is pretty certain that he separated this acid by boiling the urine, so that it is very possible that it might have been formed by decomposition of urea. Berzelius on this account declined his assent to the statement of its existence in urine. Vogel, however, demonstrated the existence in urine by placing this fluid under the air-pump in a flask, the conducting-tube of which led into lime-water, and then exhausting bubbles rose from the urine, and rendered the lime-water turbid. Vogel found uncertain indications of carbonic acid in fresh milk and bile, but met with large large quantities in the blood. A. Mariet had before performed this experiment with success, but in the hands of Berzelius it led to no result. The latter covered the urine with olive oil to prevent its frothing, but he did not find that the lime-water was rendered turbid; and hence he drew the conclusion that the turbidity in the former instance arose merely from some of the urine being carried over. Vogel's statement has, therefore, been much neglected, and nearly every subsequent writer asserts that carbonic acid rarely occurs in urine. Lehmann absolutely denies its existence in healthy urine. Brande had stated that he had found it in increased quantity in urine after carbonated liquids had been imbibed. Wöhler and Mariet throw doubt on this statement, and the latter considered the passage of carbonic acid from the stomach into the urine as a most improbable occurrence. Wöhler found carbonic acid in every specimen of urine he examined, but could not determine the quantity, because he expelled the whole of the gas by placing it in a Toricellian vacuum. He adds that he thinks more carbonic acid is contained in the urine than in the blood, and that any additional amount of carbonic acid entering the body most probably passes off through the lungs.

Looking at the amount of carbonic acid contained in the blood, the water of which is partly carried off by the kidneys, it would be surprising if the urine were entirely free from carbonic acid. So long as the urine has not an alkaline reaction the acid must exist in a free state. Since the blood of every animal contains alkaline carbonates, which pass off into the urine, the acid nature of the latter leads to the inference that carbonic acid must exist in it.

On this point I examined the urine in the following manner:—

A tall bottle was half filled with the fluid immediately after it had been passed. The bottle was then closed with a cork, through which two glass tubes were passed. One of these tubes was straight, and dipped just below the surface of the urine, and reached about four or five inches above the neck of the bottle. The other was twice bent at right angles. This acted as the conducting-tube, and dipped into a bottle containing barytic-water.* This also was filled with a cork having two holes in it, through one of which a bent tube was passed; and another, bent at right angles, passed through the second hole, and reached to the bottom of a bottle filled with barytic-water.

This bottle also was closed in the same manner, only the conducting-tube, instead of dipping into barytic-water, opened into the air. The apparatus was placed under the receiver of the air-pump, which was slowly exhausted; the urine then rose in the straight tube of the bottle, and air escaped simultaneously from the conducting-tube through the solution of baryta.

If the urine contained carbonic acid, the liquid, before clear, immediately became turbid. On the return of air into the receiver the barytic-water does not ascend into the urine, because air can enter through the upright tube. I have repeated this experiment above a score times, and have found that the urine of persons of most various constitutions always contained carbonic acid where it had an acid reaction. I have examined the urine passed in the morning and that in the evening. Directly after half an hour's immersion in a cold-water-bath it was very aqueous, and had a specific gravity of 1.0045. Carbonic acid was invariably evolved.†

I thought it very desirable to determine as nearly as possible how much of the acid existed in a gaseous state. 330 grammes of urine were taken at twelve at noon from a person who had only taken bread and milk previously on that day, and were treated as above described. The sp. gr. of this urine was 1.013. The urine being still warm when placed under the air-pump, gas was evolved with great rapidity, and in great abundance, and the amount of carbonic acid remaining in the urine must have been very small indeed. The carbonate of baryta was converted into sulphate of baryta, and its weight determined. It amounted to 0.214 grm., answering to 0.0403 grm. of carbonic acid.

About half an hour after the noon meal, consisting of soup, roast meat, and vegetables, 495 grms. of urine, sp. gr. 1014, gave 0.359 grm. of sulphate of baryta, or 0.0677 grm. of carbonic acid. Urine passed by a child eighteen months old gave a distinct evolution of carbonic acid.

The carbonic acid may be totally expelled from the liquid estimated quantitatively by placing the urine in a glass flask, closed by a cork perforated with two holes. Through one hole an upright tube passes air-tight, dips into the liquid, and terminates at the other in a fine, easily-fused point. A tube twice bent passes through the second hole and extends into an empty bottle through a cork, which closes it and prevents the access of air. A second tube passes from this bottle through the same cork, and extends into a bottle similarly fitted up and filled with barytic-water, and to this last a second and third bottle, containing barytic-water, are adapted. The last of these bottles is connected with the air-pump. When the apparatus has been examined, and found to be perfectly air-tight, the urine is placed in a water-bath, and its temperature raised to 120° or 140° F.; the pump is then slowly set in motion. Ebullition shortly commences with great violence, and the liquid distils into the empty flask at the receiver, and the barytic water becomes turbid. When the liquid has boiled from half to three quarters of an hour, the point of the first upright tube is snapped off, and air is several times drawn through the apparatus, more than enough to free it from carbonic acid. The carbonate of baryta is weighed, or else converted into sulphate of baryta, and the amount of carbonic acid obtained by calculation. 326 grms. of urine, sp. gr. 1.012, yielded 0.286 grm. of sulphate of baryta, or 32 cb. c. of carbonic acid. 225 grms. of urine, sp. gr. 1.017, yielded 0.205 grm. of sulphate of baryta, or 23 cb. c. of carbonic acid. The evolution of carbonic acid from urine voided after the exhibition of a considerable quantity of artificial Seltzer water was by no means great. In two experiments it amounted in 200 cb. c. of urine to 21 cb. c., and in 255 cb. c. to 26 cb. c. of carbonic acid. This agrees exactly with Wöhler's result. Carbonic acid is not the only gas contained in urine. That the elements of atmospheric air exist in it we may satisfy ourselves with very little trouble. Their quantity is very small, which renders their precise determination troublesome. In the fresh fluid of ascites, although containing abundance of urea, I was unable to detect carbonic acid. But it always exists in new milk. In my experiments this fluid was drawn immediately from the cow into the apparatus. There was a slight yet decided evolution of carbonic acid under the air-pump, and this increased when the fluid was heated to boiling. The reaction of the milk was alkaline; the carbonic acid must have existed either in form of a bicarbonate or as absorbed by an alkaline phosphate. Bile newly taken from an ox gave but feeble indications of the presence of carbonic acid.—*Journ. für Prakt. Chem.*, Dec., 1848.

* Barytic-water answers better than lime-water; its reaction is more signal, and instantly evident. A negative result has no doubt been obtained in many of the earlier experiments through using lime-water.

† In order to prevent any of the urine spirting over, which without some such caution will often happen, I covered the urine with oil; but the evolution of carbonic acid was in nowise diminished thereby.

ON THE EQUIVALENT OR COMBINING VOLUMES OF SOLID BODIES.

By GEORGE FOWNES, Esq., F.R.S.

The first volume of the works of the Cavendish Society contains two important and interesting memoirs on the above subject, namely,

a report by Professor Otto, of Brunswick, being a summary of the results of the labours of MM. Kopp, Schroeder, and others of the earlier continental experimenters; and a paper by M. Filhol, translated from the "Annales de Chimie et de Physique," containing a number of new determinations of the specific gravities of various substances of great importance to the theory of combination by volume. The inquiry itself being one which at present excites great interest, while the circulation of the volume containing the papers referred to is limited to the members of the Cavendish Society, a notice of some of the principal facts which have yet come to light may not prove unacceptable to the reader.

The researches under consideration constitute an attempt to extend to solids and liquids the law regulating combinations among gaseous bodies discovered many years ago by M. Gay-Lussac, in virtue of which chemical union among these latter always takes place between equal volumes of the combining gases, or between volumes which bear a simple relation to each other. It is further invariably observed, that the contraction of bulk which so frequently follows combination, itself also bears a simple relation to the volumes of the combining gases. The consequence of this is that compound gases, and the vapours of complex volatile liquids (which are truly gases to all intents and purposes), follow the same law as elementary bodies, when they unite with these latter or combine among themselves.

The ultimate reason of Gay-Lussac's law is clearly the remarkable relation established by the hand of Nature between the specific gravity of a body in the gaseous state and its chemical equivalent; a relation of such a kind that quantities by weight of the various gases expressed by their equivalent numbers, or, in other words, quantities by weight which combine, occupy under similar circumstances of pressure and temperature either equal volumes, or volumes bearing a simple proportion to each other.

If both the specific gravity and the chemical equivalent of a gas be known, its equivalent or combining volume can be easily determined, since it will be represented by the number of times the weight of an unit of volume (the specific gravity) is contained in the weight of one chemical equivalent of the substance. In other words, the equivalent volume is found by dividing the chemical equivalent by the specific gravity. The subjoined table of the principal gaseous elementary bodies is thus constructed:—

	Specific gravity.	Equiv. weight.	Equiv. vol.
Hydrogen	.0693	1.	14.43
Nitrogen	.972	14.	14.40
Chlorine	2.470	35.42	14.33
Bromine vapour	5.393	78.26	14.51
Iodine vapour	8.716	126.36	14.50
Carbon vapour (hypothetical)	.418	6.	14.34
Mercury vapour	7.000	100.	14.29
Oxygen	1.1057	8.	7.23
Phosphorus vapour	4.350	31.38	7.21
Arsenic vapour	10.420	75.21	7.21
Sulphur vapour	6.654	16.09	2.418

Thus it appeare that hydrogen, nitrogen, chlorine, bromine, iodine, carbon, and mercury in the gaseous state, have the same equivalent volume; oxygen, phosphorus, and arsenic one half of this, and sulphur one sixth. The slight discrepancies in the numbers result chiefly from errors in the determination of the specific gravities.

Compound bodies exhibit exactly the same results:—

	Specific gravity.	Equiv. weight.	Equiv. vol.
Water vapour	.625	9.	14.40
Protoxide of nitrogen	1.525	22.	14.43
Sulphuretted hydrogen	1.171	17.09	14.59
Sulphurous acid	2.210	32.09	14.52
Carbonic oxide	.973	14.	14.39
Carbonic acid	1.524	22.	14.43
Light carburetted hydrogen	.559	8.	14.31
Olefiant gas	.981	14.	14.27
Binoxide of nitrogen	1.039	30.	28.87
Hydrochloric acid	1.269	36.42	28.70
Phosphuretted hydrogen	1.240	34.38	27.72
Ammonia	.589	17.	28.86
Ether vapour	2.586	37.	14.31
Acetone vapour	2.022	29.	14.34
Benzol vapour	2.738	78.	28.49
Alcohol vapour	1.613	46.	28.52

Strictly speaking, some of these compounds have no true chemical equivalents, inasmuch as they form no direct compounds. In these cases the equivalent is deduced from the formula commonly assigned to them, which must stand in some very simple relation to the real formula, whatever the latter may be.

In forming such tables it must oviously be a matter of perfect indifference what body is chosen as the standard of specific gravity, whether oxygen, hydrogen, atmospheric air, or any other substance; the numbers representing the combining volumes will be altered by any alteration in the standard of specific gravity, but the relation between them will remain the same. The same remark applies to the equivalent weights; either of the scales in use may be taken, provided it be adhered to throughout.

Let us now turn to the consideration of combinations among solid substances, and try to see if any such simple and beautiful law is to be traced among these phenomena. The same mode of proceeding is here adopted; the combining volume is found by dividing the equivalent by the specific gravity, and represents in the same manner the number of unities of volume contained in one equivalent of the substance under consideration. In the following table of elementary substances, the scale of equivalents having oxygen equal to 100, in general use on the Continent, has been adopted, while the specific gravities are, as usual, referred to water. In very many cases these latter are more or less uncertain, and fresh determinations require to be made. The results, therefore, must be considered as approximative only, and subject to future correction.

	Specific gravity.	Equiv. weight.	Equiv. volume.
Antimony	6.72	1613	240
Arsenic	5.86	938	160
Bismuth	9.85	2660	270
Bromine	3.06	1000	326
Cadmium	8.60	697	81
Chlorine, liquefied	1.38	443	320
Chromium	5.10	329	64
Cobalt	8.39	369	44
Copper	9.00	396	44
Gold	19.10	2458	128
Iodine	4.93	1586	320
Iridium	21.60	1232	57
Iron	7.70	350	45
Lead	11.35	1294	114
Manganese	8.00	346	43
Mercury	13.60	1250	92
Molybdenum	8.68	596	68
Nickel	8.41	370	44
Osmium	21.80	1243	57
Palladium	11.70	666	57
Phosphorus	1.77	392	222
Platinum	21.60	1232	57
Potassium	.84	482	583
Rhodium	11.40	652	57
Selenium	4.30	495	115
Silver	10.40	1350	130
Sodium	.99	290	292
Sulphur	1.99	200	100
Tellurium	6.26	802	128
Tin	7.28	736	101
Titanium	5.33	302	56
Tungsten	17.10	1183	70
Zinc	6.95	406	58

From an inspection of this table it is obvious that the simplicity presented by the phenomena of gaseous union does not here exist. Still, however, relations may be observed which are too close and too numerous to be the result of accident. For example, several members of the same natural family or isomorphous group of elements have the same equivalent volume.

I.	
Cobalt	44
Copper	44
Iron	45
Nickel	44
Manganese	43
II.	
Iridium	57
Osmium	57
Palladium	57
Platinum	57
Rhodium	57
III.	
Molybdenum	68
Tungsten	70
IV.	
Bromine	326
Chlorine	320
Iodine	320

The equivalent volumes of selenium and sulphur, gold and silver, are also nearly the same; those of zinc and chromium, which belong to the first group, present serious discrepancies.

The equivalent volume of a compound of simple constitution is sometimes made up of the equivalent volumes of its components; in other cases condensation appears to have taken place in the act of union:—

	Specific gravity.	Equiv. weight.	Equiv. vol.	Sum of Vols. of constituents.
Sulphuret of copper	4.16	596	144	144
Sulphuret of silver	6.80	1550	228	230
Bisulphuret of iron	5.08	750	147	245
Sulphuret of potassium	2.13	689	323	683
Sulphuret of sodium	2.47	490	198	393
Chloride of potassium	2.00	932	466	903
Chloride of sodium	2.24	733	327	612
Iodide of lead	6.38	2880	452	434
Iodide of silver	5.50	2936	534	450

In most of the few instances cited above some approach to a regular law seems to exist, that is, if a very wide margin be left for practical errors of observation and sources of discrepancy to be presently noticed. The volumes of the sulphurets of copper and silver agree with the sum of those of their components; in bisulphuret of iron the volume of the sulphur has suffered contraction to one half; in the formation of the sulphurets of potassium and sodium a condensation amounting to one half of the whole has taken place; the same remark applies to the chlorides of these two metals; in the iodide of lead no contraction has taken place.

One of the most curious and remarkable points which has yet come to light is the observation of M. Schroeder, that when from the calculated specific volumes of a series of analogous compounds, as oxides, chlorides, or other salts, the numbers representing the volumes of the respective metals or metallic oxides be deducted, the same number is often left as the representative of the volume of the common constituent of the series. The nitrates of baryta and strontia, the sulphates of zinc and copper, the carbonates of baryta and zinc, may be thus compared:—

	Eq. vol.
Nitrate of baryta	501
Baryta	175
Nitric acid	326
Sulphate of oxide of zinc	294
Oxide of zinc	90
Sulphuric acid	204
Carbonate of baryta	294
Baryta	175
Carbonic acid	119
Nitrate of strontia	466
Strontia	140
Nitric acid	326
Sulphate of oxide of copper	280
Oxide of copper	76
Sulphuric acid	204

Carbonate of oxide of zinc....	209
Oxide of zinc	90
Carbonic acid	119

This rule, however, does not seem to be general; or, at any rate, the same number does not always represent the combining volume of the same substance, neither do the different numbers obtained by this indirect method bear any simple relation to each other.

There are many considerations which tend to show that any law connecting the volumes of solids and liquids with their chemical equivalents must in all probability be disguised and obscured by circumstances which are really or practically inoperative in the case of gases, in addition to which the law itself may be of a more complex nature, and in this respect more in accordance with the varying properties and physical constitution of the bodies subject to its influence. The extreme uniformity and simplicity of the law of gaseous combination is intimately connected with the close uniformity of physical constitution enjoyed by all gases, independently of their chemical nature.

The effect of heat upon the different gases is sensibly the same; their rates of expansion, under ordinary circumstances, are so nearly identical that for almost all practical purposes the differences may be neglected. The same ratio, therefore, between the specific gravities of these bodies will always be preserved, and observations made upon them be thus independent of the effect of temperature, provided that the particular temperature chosen be maintained throughout all the experiments. But with solids and liquids the case is widely different. Each of these bodies has its own particular rate of expansion by heat; the relative specific gravities of a number of such will vary exceedingly with the temperature at which the observation is made. In determining the specific gravities of numerous solids and liquids, therefore, with a view of forming a table of their comparative combining volumes, the question will at once arise, at what temperature this comparison is to be made? Will the same temperature serve for all, or must the specific gravity of each individual substance be taken at some particular normal temperature of its own? If the latter, how is this normal temperature to be found? Is it, as some have supposed, related to the melting or boiling point of the substance? In what way, in short, is it hoped that bodies may be fairly compared under similar physical circumstances with respect to temperature?

Another very great difficulty springs from the modifications in the specific gravities of solids, arising from differences in the state of aggregation. Among the metals, for example, especially those which present the character of malleability, the variations of specific gravity are extreme. Finely-divided metal reduced by hydrogen, the same metal melted into a button, and the button, after rolling or hammering, present differences as great as those between one metal and another. Carbon in the state of lampblack, in that of graphite, in that of the hard deposit in coal-gas retorts, and in that of diamond, is not physically the same substance. The same remark applies to sulphur, which is capable of existing in two or three different states of aggregation, having two or three different specific gravities to correspond.

These remarks are by no means intended to deter those who may be willing to pursue this very important and interesting inquiry, but merely to point out some of the difficulties which beset the subject. That a real law of volumes does exist is in the highest degree probable, and that its discovery will in the end reward the diligence of those who seek it we do not doubt; but that the inquiry is yet in its infancy, and that the very foundations of this branch of research have yet to be laid by a solution of the preceding questions, we also fully believe.

It is rather extraordinary that the papers of MM. Otto and Filhol contain no notice of the elaborate investigations of Messrs. Playfair and Joule, published in "The Memoirs of the Chemical Society of London." The first of these, especially, contains an immense number of determinations of specific gravities of salts. The attention of the authors was chiefly directed to the subject of the volume occupied by salts in solution, but the valuable data preserved in this memoir are also applicable to other purposes.—*Pharmaceutical Journal.*

TO OUR READERS.

Owing to the temporary absence of the editor we are compelled to defer the paper on Sugar, and the continuation of "Our Own Series," till next week.

THE CHEMICAL TIMES.

SATURDAY, JANUARY 20, 1849.

THE RESPONSIBILITY OF DISPENSERS.

We publish in another part of our columns a report of the "highly satisfactory" result of Mr. M'Dougell's complaint against Mr. Hooper, or rather against that gentleman's assistant, for gross neglect in making up of one of Mr. M'Dougell's prescriptions.

We should not now revert to the subject were it not that Mr. Hooper's explanation of the circumstances of the case contains certain points which we cannot consider quite so satisfactory as Mr. M'Dougell himself and Sir G. Carroll would seem to have done.

Mr. Wire, Mr. Hooper's legal adviser, stated that the latter gentleman's mode of conducting business was this—"that if he should not happen to be at home to make up a prescription his assistants were not to do so, but to send it to a neighbouring chemist. In this instance one of them had departed from that rule, and it was with deep regret that Mr. Hooper was obliged to say so. However, he had taken precautions that, for the future, such a mistake should not occur."

From this statement, then, it would appear that Mr. Hooper was perfectly aware of the unfitness of his "assistants" for the performance of the responsible duties of dispensing. He had, in fact, forbidden them to meddle with the making up of prescriptions. Now, we cannot well understand how a chemist can possibly deem it either to his own, or to the public's, advantage to employ—not one—but several totally unfit persons to act as his assistants in a business of which they professedly understand nothing; and thus to hand over, should circumstances require his temporary absence from home, the reputation of the physician and the life of the patient to the tender mercies of a set of individuals who, to their admitted ignorance, would seem to join a total absence of any sense of moral responsibility.

We think it is high time that an energetic move should be made by the profession to put a stop to the present most iniquitous system which permits unqualified individuals, whether principals or assistants, to dispense medicines, and thus, by their ignorance or reckless negligence, to put in jeopardy both the life of the patient, and the reputation of the physician. We would make it imperative upon every chemist and druggist to pass a regular examination before he should be permitted to exercise his calling; and we would likewise have him constrained to engage as assistants none who have not passed through the same ordeal. It is only when we shall have succeeded to place the dispensing of medicines exclusively in the hands of truly professional chemists and druggists, aided by duly qualified and *adequately remunerated* assistants, that we may hope to behold the cessation of the lamentable accidents "by mistake in making up prescriptions" which are a disgrace to our country.

While on this subject we beg to call the attention of our readers to a letter which we reprint from the *Times* of Wednesday, the 17th instant, and which contains some very sensible remarks on the unfortunate habit of many prescribing physicians to write their prescriptions in characters which nine dispensers out of ten find it exceedingly difficult, if not altogether impossible, to decipher. There can be no doubt but that this unfortunate system of hieroglyphing prescriptions, instead of writing them in a clear and legible character, constitutes one of the most fertile sources of mistakes in dispensing.

THE CHOLERA AT TOOTING.

We copy the following excellent article from the *Medical Times*:—

The proceedings occasioned by the late melancholy occurrence at Tooting shows the inefficiency of the Board of Health, as at present constituted. Fortunate was it, indeed, that so observant and intelligent a gentleman as Mr. Grainger was sent to investigate and remedy, in as far as human power was able, an evil which, had common prudence and rationality been exercised, would never have arisen.

The precipitate and highly injudicious steps taken by the Board of Health, in sending to Tooting fifty labourers, armed with pickaxes, scoops, &c., to upturn noisome trenches as a remedy for cholera, is a pretty good specimen of what may be expected from the board; and, but for the experience and intelligence of the beforementioned gentleman, the consequences would have been, in all probability, more fatal and greatly aggravated.

The malady which broke out in Mr. Drouet's establishment at Tooting, strictly speaking, can scarcely be recognised as cholera, while the symptoms and suddenness of the invasion plainly point out the cause.

From 1,400 to 1,500 children occupied, as dormitories, buildings in seven compartments, each of which were fifty feet in length and twenty-four in breadth; a range of buildings 150 in length; also two old family mansions. Why, on a moderate calculation, these unhappy children must have been packed, for the purpose of sleeping, as close as figs in a drum. And, pray, what ventilation had these 1,500 breathing subjects duaing the sleeping hours? We are not exactly told, but are informed by one of the medical gentlemen who was called to assist in the treating of the numerous cases, that he found the children four and five in a bed for want of room; and, by another, that sufficient provision had not been made for warming the apartments; from which we may infer that all apertures were stopped to remedy, during the cold weather, the deficiency of warmth which should have been managed after a more appropriate fashion. We are also told that these unfortunate sufferers were insufficiently clad and fed; the presumption, therefore, follows that they were not overburdened with bed-clothes, at this and at all seasons, to protect the person, during sleep, from atmospheric influence, when it is less capable of resisting the noxious impressions of sudden vicissitude.

Looking to the evidence given throughout the

investigation of this matter, there cannot be a doubt in the minds of experienced persons that insufficient food and raiment, and the privation of vital stimulus in the shape of pure breathing air, from crowding in insufficient spaces such a number of children, were the predisposing causes; and that peculiarities of atmosphere, in which is comprised hygrometric influence, atmospheric pressure, electrical tension, &c. &c., were the exciting causes.

An occurrence parallel (so far as atmospheric poisoning) to the one in question, as reported by Sir George Baker, will be found recorded in the third volume of the "Medical Transactions of the Royal College of Physicians," as far back as 1782. Seventy-three children, belonging to the parish of St. James, Westminster, were removed in the month of September, about the 28th, from Wimbledon, where they had been maintained at the expense of the parish, to a large house in King-street, near Gordon-square. The children, who were in good health on occupying this house, became suddenly indisposed; first one, and soon after many others. On the 8th of October the first case occurred; the symptoms were, excruciating pain in the stomach, back, and limbs, with delirium and costiveness. Many were relieved by spontaneous discharges, by vomiting, and by stool. Nothing could be detected in the cooking utensils or in the locality to account for the disease. It was, however, observed, that the cases were confined to a certain room of the house, which had been painted, as had all the other rooms, a month before occupation. The bedroom was twenty feet long and sixteen broad. Ten beds were placed in it, and were occupied by eighteen persons. This room had also been a favourite one, on account of its warmth, and had been generally crowded at night by a greater number than its complement. It was also discovered that, in order that as much space as possible might be made for beds, the chimney had been stopped up with bricks! and it had been the constant custom of the servant at night to keep the door shut, and the window-shutters closed, so as to exclude all air. In the adjoining chamber of the same dimensions, and painted at the same time, eighteen girls slept on nine beds; the chamber differing only in having an open chimney, and not being so closely shut up at night, none of the children suffered. A striking fact was also noticed, that a servant-girl in attendance as nurse only one night in the fatal chamber suffered as the others, with delirium, &c.

The paint, in this instance, evidently gives character to the disease,—the colicky and constipated symptoms.

We shall not here attempt to discuss the question as to what share malaria or fœtor from imperfect drainage, which seems to have been hunted for with much avidity, had in the Tooting affair; but observe, that it is somewhat extraordinary that in all legislative and other proceedings for sanitary purposes the cesspools and sewers seem to be the chief object of solicitude,—the all-engrossing subject is the noxious properties of stinking vapours, as though there were no other deleterious gases surrounding our globe inappreciable to the olfactories, and of far more consequence in a sanitary point of view. Now, although vapours, arising from cesspools and imperfect drainage, unquestionably contribute one of the many predisposing causes to disease, they are not of such paramount consideration as ventilation: for, their noxious properties, from whatever source they may arise, depend more or less on their existence in open or confined spaces. The indefatigable Parent du Chatelet, in his work on "Hygiene Publique," has shown that stenches, filthy exhalations, however disgusting, are not necessarily the cause of disease, when not pent up, as *à priori* they may be supposed to be. He informs us that at one of the most extensive "chantieres d'equarrissages," situated at Montfauçon, within a mile or two of Paris, occupying a large open space of ground, were thousands of horses, dogs, and cats are taken yearly to be slaughtered, and where almost all the ordure of Paris is collected together, the most abominable stenches are to be met with; the ground saturated with the blood of the murdered animals sends forth a most disgusting fœtor, as do also the enormous mounds of putrid flesh for the purposes of manure, and the generation of maggots for the feeding of poultry! Yet the workmen living and employed in these places, in the filthy occupations of glue and music-string making, &c., enjoy an immunity from disease that is truly astonishing, and their exemption from illness during the destructive prevalence of cholera in Paris was equally remarkable. The existence of such disgusting nuisances, as represented by Duchatelet, can by no means be approved of; but reference to them here is made to show, by well-ascertained facts, that the remedying of the effluvia arising from imperfect drainage, cesspools, *et hoc genus omne*, is not of such vital importance in a sanitary point of view, as not only to take the lead, but engross much, if not all, attention in sanitary reform. All sanitary measures, to be effective, must be based on ventilation, which, by striking at the root, will remedy all—much more than the olfactories will guide to. Ventilation, by supplying the vital stimulus, the very *pabulum vitæ*, not only fortifies the system against the poisonous effects of the various deleterious compounds of the atmosphere, by enabling it to bear up against them, but also to resist, to a great extent, atmospheric vicissitudes, the grand excitant of all maladies, whether of an endemic, pandemic, sporadic, or epidemic nature.

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON JAN. 17, 1849:—				
In London and vicinity, viz.:—				
Whitechapel	2			
London-docks (on board ship)	1	1		
Hackney (from Tooting)	1	1		
Wandsworth	6	4		
Battersea (Althorpe-house)	1			
In the country, viz.:—				
Workhouse, Howden Union	6	..	4	
Reading	1			
Wakefield	3	2		
In Scotland, viz.:—				
Edinburgh	2	2	2	
Glasgow	62	19	30	
Old Monkland	18	8	3	
Wiston by Biggar	1			
Jedburgh	1	..	1	
Selkirk	2	..	1	
Total new cases	107	37	41	
In London and vicinity	756	420	109	227
In the country	511	247	51	213
In Scotland	6665	2912	1638	2115
Total	7932	3579	1798	2555

MORTALITY IN THE METROPOLIS.

The interesting document which is issued weekly by the Registrar-General shows that the deaths in the metropolis, from all causes, during the week ending Saturday, Jan. 13, amounted to 1,448, and the births to 1,421. The weekly average of deaths for the winters of 1844-5-6-7-8 was 1,169. In the week just ended the deaths of males have been 697; of females, 751; giving an excess of 54 of the latter. Compared with the weekly average of the last five years, the increase of female deaths is 105, and that of males 174. It will be seen that the 1,448 deaths registered in the week exhibit an excess of 279 on the weekly average of five winters. It is produced to a great extent by the sudden increase of mortality from bronchitis and inflammation of the lungs, the deaths from which were 279; those of the former weeks having been 170, while the average is 181. But the excess is principally due to zymotic or epidemic diseases; the deaths enumerated in this class were 407, and amount to nearly double the average. Scarlatina, which is on the decline, was fatal to 63 persons, or double the average; whooping-cough, to 68, the average being 42; typhus, to 83, the average being 42; and cholera, to 94, though this disease, when it is not epidemic, carries off on an average less than 1 in a fortnight at this season of the year. The mortality from smallpox (21) corresponds exactly with the average from this disease. Mr. Leonard states that "Scarlatina of bad type exists in the district to which he is one of the medical officers. A family in Castle-street, Leicester-square, has lost six children out of seven—three from the form called 'cynanche maligna,' and three from anasarca after scarlatina. The children were of uncleanly habits, and the atmosphere of their apartment was intolerable from ammoniacal gas. The rest of the house, though adjoining stables, was unaffected and free from unpleasant odour." Mr. Robinson, of the Berwick-street sub-district, also mentions a family of eight persons, all living and sleeping in a room of about 10 feet by 14, at No. 7, Green's-court, in which three children have died of the same disease within eleven days, and a fourth was afterwards attacked.

The fatal cases of cholera registered in the week are as follow:—

KENSINGTON; Town.—In Kensington workhouse, M. 10, "cholera (4 days)." One of the pauper children removed from Drouet's school at Tooting.

CHELSEA; North-west.—M. 8, "cholera;" M. 52, "cholera."

MARYLEBONE; All Souls.—F. 11, "cholera Asiatica (48 hours)." Mr. Selby, the deputy-registrar, states that "this girl died in the house taken by the Strand union, in Ogle-mews, for the reception of children removed from Mr. Drouet's establishment. When he was taken over the premises, in which excellent arrangements have been made, there was no further appearance of the disease."

ST. PANCRAS; Tottenham.—At 6, Tottenham-court, New-road, widow of a baker, 66, "English cholera (1 week)." Camden-town.—M. 7, "Asiatic cholera (12 hours);" M. 7, "Asiatic cholera (24 hours);" M. 5, "Asiatic cholera (28 hours);" M. 7, "Asiatic cholera (57 hours);" F. 8, "Asiatic cholera (24 hours);" F. 8, "Asiatic cholera (24 hours)." Mr. Holl, the registrar, states that "The above six deaths were of children who had been removed from the establishment at Tooting to St. Pancras workhouse. Happily, the disease is nearly subdued in the workhouse."

WHITECHAPEL; Goodman's-fields.—At 88, Leman-street, a labourer, 40, "Asiatic cholera (23 hours);" at the same house, son of the above, 7, "Asiatic cholera (12 hours)."

ST. OLAVE; St. John.—At 2, Griffith's-rents, a dressmaker, 25, "malignant cholera (14 hours)." Mr. Bensted, the registrar, states that "The above case occurred in a filthy place exposed to an open sewer."

BERMONDSEY; St. Mary.—At Mellick-place, F. 45, "diarrhœa (2 days); cholera Asiatica (17 hours)."

ST. GEORGE, SOUTHWARK; London-road.—M. 8, "cholera (25 hours)."

NEWINGTON; Walworth.—M. 4, "cholera (3 days);" M. 9, "cholera (13) hours. The latter case is that of one of the children removed from Mr. Drouet's institution at Tooting.

Wandsworth and Clapham; Wandsworth.—M. 7, "Asiatic cholera (24 hours);" M. 36, "cholera (27 hours);" F. 5, "Asiatic cholera (29 hours)." Battersea. — At Church-street, gamekeeper, 60, "malignant cholera (11 hours);" at Church-street, M. 33, "malignant cholera (14 hours);" at the union workhouse, an orphan, 8, "malignant cholera (5 days);" at the union workhouse, widow, 40, "cholera."

Wandsworth and Clapham. — Streatham and Tooting Graveney.—The following list contains all the deaths registered in the week, amounting to 77, which occurred in Mr. Drouet's Infant Poor Establishment, Surrey-hall, inclusive of eight certified as caused by diarrhœa, dysentery, mesenteric disease, &c. The total deaths registered in this and the previous week, which have occurred in the institution or amongst children who have been removed from it since the appearance of the epidemic, amount to 140, of which 122 were returned as caused by cholera, though most of the others were probably connected with the epidemic :—F. 7, "cholera (2 days);" F. 8, "cholera (18 hours); M. 4, "cholera (24 hours), mesenteric disease (several weeks);" F. 15, "cholera (3 days);" M. 8, cholera (23 hours);" M. 8, "cholera" (10 hours);" M. 10, "cholera (13 hours);" F. 8, "pneumonia (4 days), cholera (24 hours);" M. 10, "chronic mesenteritis (4 weeks), atrophy;" F. 7, "cholera (48 hours);" F. 3, "cholera (48 hours);" M. 4, "diarrhœa (3 days), cholera (48 hours); M. 5, "cholera (20 hours);" M. 11, "cholera (60 hours);" M. 6, "cholera (67 hours);" M. 7, "dysentery (4 weeks);" F. 7, "cholera relapsed (5 days);" F. 5, "diarrhœa, cholera (5 days);" F. 10 "cholera (51 hours);" M. 4, "cholera (3 hours);" M. 3, "diarrhæa, cholera (28 hours);" M. 6, "cholera (56 hours);" F. 7, "cholera (5 days), exhaustion;" M. 6, "cholera, exhaustion (5 days);" M. 8, "diarrhœa and vomiting (5 days), cholera;" M. 13, "cholera (5 days), exhaustion;" F. 7, "cholera (3 days);" F. 13, "cholera (12 hours);" M. 11, "cholera (2 days), relapsed (3 days);" F. 6, "cholera (3 days);" F. 5, "cholera (24 hours);" F. 11, "cholera;" M. 10, "diarrhœa (3 days);" F. 4, "cholera (37 hours);" F. 60, "cholera (24 hours), typhoid fever (3 days), nurse in the establishment); F. 4, "cholera (24 hours);" M. 8, "dysentery (3 weeks), debility;" F. 7, "cholera (44 hours);" F. 12, "cholera (12 hours);" F. 9, "cholera (48 hours);" M. 6, "cholera (12 hours;" M. 10, "cholera (8 hours);" M. 12, "cholera (3 days);" M. 14, "cholera (3 days);" M. 15, "cholera (4 days);" F. 62, "Asiatic cholera (12 hours)," (nurse in the establishment); F. 7, "cholera, relapse (4 days);" F. 6, "cholera (3 days);" F. 5, "mesenteric disease (some weeks), diarrhœa (2 days);" F. 9, "cholera;" F. 9, "cholera (48 hours);" M. 7, "cholera (3 days);" F. 7, "cholera (48 hours);" M. 12, "cholera (2 hours);" F. 8, "cholera (12 hours);" M. 6, "cholera (3 days);" F. 10, "cholera (12 hours);" M. 7, "cholera (2 days), exhaustion (4 days);" M. 14, "cholera, typhoid fever (4 days);" M. 12, "general debility (some weeks), diarrhœa (3 days);" F. 5, "cholera, exhaustion (5 days);" M. 9, "cholera (9 hours);" M. 10, "cholera (8 hours);" M. 6, "cholera (3 days);" F. 4, "cholera (2 days), debility (5 days);" F. 7, "cholera (2 days), debility (3 days);" F. 4, "cholera, exhaustion (4 days);" M. 8, "mesenteric disease (3 weeks), diarrhœa (3 days);" F. 6, "cholera (5 days), debility;" M. 8, "cholera, relapse (4 days);" F. 14, "cholera (2 days), typhoid fever (4 days);" F. 23, "cholera (11 hours), (single woman servant in the establishment);" M. 6, "cholera (6 hours);" F. 7, "cholera (2 days), exhaustion (3 days);" M. 6, "cholera (2 days), debility (5 days);" M. 8, "dysentery, debility (5 weeks);" M. 5, "cholera (48 hours)."

Oxfordshire.—The cholera has found its way into this county. Two cases have occurred at the village of Garsington, distant about four miles from the city of Oxford. The first case proved fatal on Saturday last, when an inquest was held upon the body of a girl, whose name was Noate, and who has been in the habit of bringing turnip greens to Oxford market. She was there on Wednesday last in her usual good health, but after a few hours' illness she died. Verdict, "Died of Asiatic cholera." The other case was that of the girl's brother, who was taken ill on Sunday, and died in the evening. The coroner was again applied to to hold an inquest, but, believing it to be another case of cholera, thought it not expedient to do so.

Wakefield, Tuesday.—Considerable alarm is felt in this town owing to the ravages which the cholera is making amongst the prisoners, and chiefly amongst those who have been the most recently committed. One of the prisoners, aged 70, who was committed from Sheffield for debt only last Thursday, died to-day from Asiatic cholera. The number of deaths in the Old Prison here up to this afternoon is 10; and a larger number are ill and under treatment. The disease has fortunately not reached the New Prison. With the exception of one death, that of a poor woman at Kirkgate, from the above disease, the town is perfectly free from the epidemic. The county coroner, Mr. Thomas Lee, has been very busy in his professional duties at the house of correction during the last few days, having held inquests upon four prisoners on Saturday (three having died of cholera and one of consumption); two on Sunday, of Asiatic cholera; three on Monday, of the same complaint; and one this morning. The evidence at the inquest was of such a nature as to lead the jury to believe that the prisoners had died of Asiatic cholera, and they returned a verdict in each case to that effect.

Belfast.—The last accounts are extremely unfavourable. The *Belfast Chronicle* of the 13th says :—"As was naturally to have been expected, cholera is slowly but steadily on the increase; the cases reported for the last three days amounting to 21 in all. The circumstances of several of these make strongly in favour of the opinion that the disease is infectious, at least under particular conditione of atmospheric loeality and bodily health; and we believe that most of the professional gentlemen who have paid attention to the various cases since the malady first appeared in town are now inclined to this side of the question. On Wednesday 8 new cases were reported, 2 deaths, no recoveries; on Thursday 7 new cases, 4 deaths, 1 recovery; and yesterday 6 new cases, 2 deaths, and 1 recovery; making the total since the commencement 103 cases—42 deaths, 37 recoveries, and 24 remaining under treatment. Of the new cases reported yesterday but one occurred in the town, the others being in the union workhouse." The *Belfast Chronicle* of the 15th says :—"On Saturday there were ten cases, being the largest number yet reported in any day since its appearance, while yesterday up till the hour of making up the return there were but three cases in all. The subjoined is the official report :—Saturday, remaining, 24; new cases, 10; deaths, 6; recoveries, 0; remaining, 28. Sunday (yesterday), remaining, 28; new, 3; deaths, 4; remaining, 27. Of the new cases four were relapses not hitherto reported."

THE CHOLERA AMONG THE PAUPER CHILDREN AT TOOTING, &c.

OFFICIAL REPORTS.

On Wednesday the following official statements were received by the Board of Health, and the other authorities, with respect to the state of the children still remaining at Tooting, and who have been removed therefrom :—

"Surrey-hall, Tooting, Jan. 17.

"We have much pleasure in reporting that matters here are progressing favourably. There has been no fresh case of cholera since Sunday, and the cases under treatment are so rapidly improving as to leave no doubt but the health of this establishment will in the course of a few days be perfectly restored.

Number now under treatment	65
Died	1
New cases	0
Convalescent	16

"W. Home Popham, Surgeon.
"William J. Kite, Resident Surgeon."

The following were received by the authorities of St. Paneras at the sitting of the committee of the board of directors on Wednesday :—

"Temporary Hospital, St. Paneras, Jan. 16.

"The night has again passed over without any fresh cases or deaths occurring among the children, but I regret to add my head-nurse (Blake) was attacked last evening, and now remains in extreme danger on account of her age (74). Two of the females are not quite so well this morning, having experienced a slight relapse.

"Henry Bird, Surgeon."

"Temporary Hospital, St. Paneras, Jan. 17.

"The children generally are quite well and exceedingly cheerful. There have been no fresh cases or deaths, and poor old nurse Blake I consider rather better, but, of course, she has age to contend against. The two children alluded to in my report dated yesterday remain in nearly the same state.

"There are two cases of diarrhœa amongst the boys, but not of that character to justify me in calling them even of a premonitory appearance. "Henry Bird, Surgeon."

The reports at the Holborn union and Strand union were that the condition of the children removed from Tooting to the Royal Free Hospital and to the Refuge for the Destitute in Ogle-street, Marylebone, was favourable, only a few cases of diarrhœa having occurred since the last reports.

The Holborn Union.—The following is the official report made to the weekly board of the Royal Free Hospital of the children received from Tooting belonging to the Holborn union :—83 boys, 71 girls, total 154, were admitted on the night of the 5th inst., of whom 87 were attacked by the Tooting malady, viz., 39 girls and 48 boys. Four of these (2 girls and 2 boys) died within 48 hours of admission; 70 have been cured, viz., 42 boys and 28 girls; remaining under treatment, but convalescent, 4 boys and 9 girls. The number of children not attacked by the malady, and now in good health, is 67, making together the total, 154.—W. Marsden, M.D., Senior Surgeon.—Board-room, Jan. 17.

THE PHARMACEUTICAL SOCIETY.

The society held its conversazione on Wednesday evening, the 17th inst. In the course of the evening 230 gentlemen were present. Among the company we distinguished Prof. Graham, R. Warrington, Esq., Dr. Pereira, Dr. Ure, and several gentlemen of the medical profession.

The proceedings were limited to the exhibition, in the spacious rooms of the institution, of instruments, apparatus, &c., varied with a little subsidiary occupation in the coffee-room. Before speaking of instruments, let us notice an object which, if not strictly scientific, is interesting to the chemist in common with his fellow-mortals. This was a case of specimens of Californian gold, supplied for the occasion, as we understand, by Mr. Tennant, mineralogist, of the Strand. The most considerable specimen in point of size was a pebble weighing 9 oz., and containing 6 oz. of gold. It appeared to have been taken from the bed of some stream, and the action of the water had completely worn off every angularity and given it the roundness of an ordinary pebble. Other specimens were in laminæ, in grains as washed, and one piece was foliated in quartz. A small amount of Cornwall gold was also contained in the case with the above.

An important instrument, furnished by the courtesy of Professor Graham, was exhibited and explained by Mr. Redwood. This was an instrument for the liquefaction of carbonic acid

and nitrous oxide by mechanical pressure only, invented and constructed by M. Natterer, of Vienna. It consists of a forcing-pump fixed in a strong oaken frame; the condensing-chamber has been placed, for what reason is not apparent, at the very top of the apparatus, which stands seven feet high. Carbonic acid has never been liquefied before by pressure alone, and, although the object of M. Natterer's invention is to accomplish this, he has arranged a chamber to hold a frigorific mixture in contact with the exterior of the condenser. The chamber in which the gas is compressed is necessarily made of exceedingly strong wrought iron, and is further strengthened by bands of the same metal. The liquid protoxide of nitrogen furnishes the means of producing an extremely low temperature. Faraday considers that it will be possible to obtain an intensity of cold by its means much greater than has ever been thought probable before. The liquid of nitrogen is colourless, very mobile, and transparent; every drop which falls upon the skin leaves a painful burn. The gas is put into the reservoir quite dry and pure, the reservoir surrounded, for the sake of greater despatch, with a body of ice, so that the pump is continually kept cool by a circulation round it. Mr. Redwood stated that it takes five hours to produce half an ounce of the liquid, and the necessary exertion is, especially in the later stages of the process, very trying, although the machine is worked by two men. When the stopcock of the reservoir is opened gas escapes; a portion at first freezes, but soon flows liquid; the solid portion is like a mass of snow. The instrument exhibited is, we should say, not a fair specimen of Austrian mechanical skill. The piston is too long, the chamber misplaced, and a great loss of power is consequent on the small size of the pump, making the process exceedingly protracted and formidable.

It had been intended to exhibit at the meeting the electric light of Mr. Staite, but some consideration of commercial policy appears to have precluded the assent of the patentee, and Staite's light was not exhibited. In order to have the next best substitute, Mr. Redwood brought out an instrument, his own property, constructed by Mr. Newman, of Regent-street, for producing an electric light by the combustion of charcoal. The battery used was that of Grove; twenty-five pairs of plates, we believe, made of amalgamated zinc and platinum, were employed, with diluted sulphuric acid and strong nitric acid, the former in the proportion of one part to six, fluid measure, and the nitric in the ordinary commercial state. A Winchester quart of nitric and two quarts of dilute sulphuric acid were used on this occasion. The battery was set in action at six p.m., and when we left, at eleven p.m., it was in good working order, and had not apparently lost any of its power. The points used were shapen out of a very hard coke, formed as an incrustation on the retort in the manufacture of coal gas. This coal coke is frequently hard enough to scratch glass, and seems to answer tolerably well for experiments of this kind. The boxwood charcoal points burnt out "in no time." The *on dit* was that Mr. Staite formerly obtained his points by making the dust of charcoal into a paste, moulding and baking it to secure a compact solid mass. Now, it is said, he takes the hard coke, such as we have described, which is somewhat too porous, and, dipping it into a solution of sugar, gets the interstices filled up by the solid matter; he then subjects the coke to heat in a close vessel, and thus, by decomposition of the sugar, a carbon is formed, which, with the previously existing coke, forms a solid and compact material for the point.

The battery in Mr. Staite's process has copper and leaden plates. With the lead nitric, with the copper sulphuric, acid is used. The patentee proposes to manufacture white lead in this way, his light standing in the relation of a waste product. He also intends to apply the combustion of the sulphuric acid and copper to the manufacture of blue vitriol. It will be seen that the economic conditions under which this patent alone can work almost of necessity restrict its use to large consumers of the light. Imagine a new set of perambulatory merchants calling from house to house to admonish the odd boy or maid to "look the blue vitriol up," or "get the white lead together." Perhaps, however, a new branch of business might be engrafted on one at present existing, and the lead and vitriol be taken off by the man who buys of thrifty housekeepers five pounds of bones for a farthing. *Mais revenons à nos moutons.* Mr. Redwood in the course of the evening took several talbotype copies by the aid of the electric light, in order to show its identity in essential properties, and perhaps in constitution, with sunlight. The talbotype impression was produced with even greater distinctness under the electric light than under the rays of the sun. About eleven o'clock the window-blind was drawn up, and a stream of light directed on the north side of Bloomsbury-square, very much to the interest of a miscellaneous crowd which soon collected. We were able to distinguish from the society's rooms the features of the individuals composing the crowd and the colour of their dress, and saw a person testing the light by reading what seemed to be a newspaper which he drew from his pocket.

In a corner of the room next the lecture theatre we observed Mr. Deane, of Clapham-common, assiduously devoted nearly the whole evening to bringing out the capabilities of a very excellent microscope. A portion of the Valisneria spiralis was under the lens, and the circulation of the sap around, between, and through the cells was very visible.

A process was explained, in the course of the evening, for making the true butter of antimony. A model of Dr. Neill Arnott's new pendulum ventilator was placed on the table. This instrument is intended to keep in motion and remove the air of an apartment by means of a fan hanging in a wooden chamber, to which a pendulous motion must be given from without, for the machine is not self-acting. We presume, although the model did not exhibit such an arrangement, that a chimney of some kind is attached for the conveyance of air out of the chamber. Dr. Arnott must mean an old clock, a jack, or, perhaps, an arrangement on the principle of the mechanical stirrer, will be employed to keep his flapper at work. The model struck us as having rather a toyish appearance.

Count Real's press reared its ungainly head, or rather pipe, in one of the apartments. This press was invented by Count Real for the preparation of extracts, and to effect a more complete penetration of the vegetable fibres and extraction of the soluble parts than had previously been accomplished. The press does this by means of the weight of a column of water contained in a tin tube, increased by elongation to the extent required. Sometimes this pipe reaches through two and even three stories of a building, but its great height is a great evil. The press exhibited was about ten feet high, but this length was found to have its inconveniences, especially as there was little room, owing to the danger of its being overturned, as a certain M.P.S.G.B. had reason to know on Wednesday evening. Internally Real's press consists of a metallic cylinder, in which the substance to be acted upon is placed on a perforated disc. It has a cover which may be fixed on with a water-tight joint, and the cover is attached to the perpendicular tube. There is another objection to this press, in the difficulty of preventing leakage at the joints. The cover to the cylinder has to be fastened on by means of screws, which is a very troublesome process, and the custody of the screws adds another to the sufficiently numerous cares of the laboratory. Of late years the low-pressure displacement apparatus has very generally superseded the high-pressure method to which Real's press is adapted. The count's method of moistening the dry substances consists in adding to the powder half its volume of water, allowing the mixture to stand some hours, then packing it more or less closely in the cylinder of the apparatus, covering it over with a piece of linen or paper pierced with holes, and, lastly, pouring water over it; and this is still the best method of effecting the object. Should the liquor run off too rapidly, the powder should be pressed a little closer in the cylinder, or the escape of the liquid be regulated by a stopcock.

Near to Real's press stood a number of very eligible apparatuses from Messrs. Griffin, of Glasgow. Among these was a small Beindorf's apparatus, which attracted much notice. This is called after its inventor, John Beindorf, of Frankfort, and is a steam apparatus intended to supersede to a great extent the use of the other methods of heating in small pharmaceutical laboratories. It has long been used in Germany and other parts of the Continent, and has become so common as to be known very generally as *the apparatus*. The principle, and also the form, have been adopted and modified by many manufacturers. The Beindorf apparatus as now made consists of a boiler made of copper, say a foot and a half long and a foot wide. The under edges are all rounded, and the bottom is arched; the sides are perpendicular, and have a flat flange, or shoulder, on which the top is fixed either by screws or solder. In the top there are several circular openings; one of these, much larger than the others, receives the cucurbite; the others vessels for evaporation, infusion, decoction, &c. The top is variously made of brass, steel, copper, or iron, according to the taste or resources of the customer. The cucurbite fits into the large opening in the top of the boiler, and a steam-pipe is fixed to a small opening of which there are several for similar purposes in the top of the boiler, and carries steam to the bottom of the cucurbite, where it is discharged underneath a false bottom which is perforated. A tin pan for evaporating neutral solutions or extracts, and a porcelain or Wedgewood dish for solutions which would act on the tin, mounted with a ring of tin, falling into the opening in the boiler, are used with the boiler in different operations. A deep copper pan, used for making larger quantities of extract, lead plaster, &c., dips into the boiler as far as a rim by which it is fitted to the opening.

The size and depth of this appendage may be suited to the wants of the operator; it is also sometimes accompanied with an external jacket, and then the pan stands above the boiler, and the steam surrounds it in the space enclosed by the jacket. Some of the apparatus have a small set of brass rings fitting one another, the other with a circular piece in the centre, the whole forming a lid for the large opening of the boiler. They are intended to contract the size of the opening, so as to suit any dish or vessel of smaller diameter. The two largest of these rings, with the still-head fitted in the centre, are used when water is distilled without the cucurbite. A funnel-shaped apparatus is also used in connection with Beindorf's arrangement. This is eight inches in diameter at the mouth of the funnel, and its neck fits into one of the second-sized openings of the boiler. There is a valve in the neck of this apparatus formed of a disc of metal across the diameter, to which a wire is fixed, so that it may be turned to effect or prevent the admission of steam into the funnel. This appendage enables the operator to adapt retorts, dishes, and other vessels in the most eligible way for receiving the heat of the steam. A small hot-air chamber is another part of Beindorf's apparatus. This is a double box with a door on one side, and a tube for conveying steam from the boiler to the space enclosed by the jacket. There are openings at opposite corners of the doors, fitted with sliding shutters, to allow air to pass when required. The Beindorf apparatus is not adapted for sending strong jets of steam through pipes, because on the least pressure the steam would escape through the imperfect joints by which the several appendages are fitted to the top of the boiler. The construction of the furnace or stove by which the boiler is heated can hardly be communicated without the assistance of engravings. It must be high enough to allow sufficient space between the beak of the still-head and the ground for the worm-tub, or re-

frigerator, and the receiver below it, or it cannot be used for distillation. There should also be space left for an arched receptacle for keeping fuel in underneath the ash-pit. The sandbath should be the full width of the furnace, and about fifteen or twenty inches in length. When Beindorf's apparatus is used for the preparation of distilled waters the boiler is charged with rather more water than usual, so that two or three gallons may be distilled without recharging it. The cucurbite is then placed in the opening in the top of the boiler, and the herbs, flowers, &c., to be operated on are put over the perforated false bottom of the cucurbite, a jet of steam is then sent through the solid ingredients by means of the steam-pipe, and becomes charged with their volatile constituents. When essential oils are substituted for the vegetable substances which yield them they may be dropped on a portion of bibulous paper, and this is placed on the false bottom. Unfortunately for the success of this arrangement the condensation of steam in the cucurbite, and the accumulation of water there so as to cover the pipe, occasion an obstruction to the free passage of the steam, and then it escapes at the joints. Alcohol and spirits generally are distilled by putting them into the alembic immersed in the water of the boiler, and the heat so communicated is found sufficient for this purpose. When small quantities of spirituous or ethereal liquids are to be distilled, a retort may be put into the funnel-shaped apparatus as before described. In the process of digestion, and in making some infusions, as the protracted and continuous application of heat is required, the Beindorf apparatus is very convenient. The solution of salts, of gum, of extracts, the liquefaction of fats, ointments, plasters, and other similar processes of the same description, are performed in the small round vessels of tin and Wedgewood ware which fit into the small openings round the boiler. Lead plaster, too, may be made in the large pan, and certainly the danger of spoiling the product by the application of too strong a heat is avoided; but, on the other hand, the time required for saponifying the oil at a water-bath heat is much more than it would be at a stronger heat. The Beindorf apparatus is not adapted to the vaporization of liquids by ebullition, for although the steam in the boiler should be a few degrees above the boiling point, yet the intervention of the metal pan, and yet more of the earthenware pan, will make the contents of the pan to be four or five degrees below it. For surface evaporation, however, the apparatus is very useful. The cheapness, compactness, and the variety of its applications, as well as the facility with which it may be handled, are great advantages; but its size renders it unequal to the requirements of the working chemist and the pharmaceutist, and the impossibility of employing it under sufficient pressure limits its usefulness most materially.

Mr. Redwood's model of a drug-mill, with its granite rollers, triturating and sifting arrangements, was constantly surrounded by the curious, and its noise frequently rendered inaudible the elucidations of its proprietor on other subjects. As it has been so recently described in the *Chemical Times* we pass on.

On the laboratory staircase hung a lamp of peculiar construction, burning a coal-naphtha, costing but 3s. 6d. per gallon. The liquid is contained in a reservoir just under the hook by which the lamp is suspended, and runs down a tube bent near its lower extremity. In lighting the lamp a little naphtha is put in a kind of cup just under the burner, which it heats. The naphtha is from the reservoir allowed to flow, when the heated metal converts it into inflammable vapour. The supply is regulated in the same way as with gas, by means of a stopcock. The smell of naphtha given off in first lighting the lamp may be got rid of by performing that operation in the fireplace under the chimney, or, better, by heating the metal near the burner by other means. No smoke or smell is perceptible when the lamp is at work; the vapour burns very strongly with a whirring noise: we were told that silent lamps were in preparation. It is called the "Holliday" lamp, after its inventor. For outdoor purposes, and in the more exposed shops, such as butchers and greengrocers, this will be a very useful lamp: its light is very strong, and withal very cheap. Small towns, unequal to the formation of a gas company, might inspect it with advantage.

At the lecture table a very beautiful patent gas-burner, the invention of Mr. R. Clark, of the Strand, was in operation. The light is diffused through an enamelled globe, or, in cases where the ordinary ground glass globe is retained, an enamelled fluted glass cup supports the globe. The old plan of having the under half of the glass globe plain, and the upper part ground, is on many accounts objectionable. The new arrangement has the effect of preventing direct rays from impinging on the eye without at all impeding the light. As it, moreover, prevents all shadow from the cock and other appendages of the burner, it must be a very desirable light for counter uses.

On the table we noticed the artificial leech, registered by Mr. Wertheimber, of Finsbury. This small instrument, designed to render therapeutics independent of the freaks and fancies of the officinal agent, consists of an external case of glass or metal, and a small disc or button forming a top to the case. To the interior of the glass a metallic piston is adapted, covered and made to fit airtight to the glass with vulcanized indiarubber or some other flexible substance. The piston and the disc are connected by a band of indiarubber. The instrument is used in the following manner:—A puncture or cut is made with the lancet in the part to be bled, and the lower end of the instrument is just moistened; a small pressing-rod passes through the disc till the end of it comes in contact with a cup formed in the top of the piston. The piston is now pressed down by means of the rod, and the instrument is applied over the puncture or cut previously made; the expanded elastic band of indiarubber obeys its tendency to contract as soon as the pressure on the rod is withdrawn, and the piston is by it pulled back again in the case: in this way a constant, gentle sucking action is kept up until the space beneath the piston is nearly filled with blood.

We have only space, in conclusion, to enumerate the remaining objects of interest which made up the collection on this occasion. The chief of these were an apparatus for the continuous process of making phosphoric acid; models of a soda-furnace, of a vitriol-chamber, and of a sulphur-burner; an instrument for Centigrade testing; a Clarke's water-tester; a circular and three-sided sifting-machine; a box made entirely of sassafras-wood; and a case of corundum files. The party separated at half-past ten, every one seeming pleased with the entertainment and with himself.

CHEMICAL SOCIETY.

Dec. 4, 1848.—The president in the chair.—The following papers were read:—

1. "On a Balance Galvanometer," by W. S. Warde, Esq. This galvanometer consists of a coil of covered copper wire in the form of a parallelogram, the ends of the wire being extended so as to form pivots, on which the coil is balanced; and by these pivots the current passes through the coil. Two short arms are attached to the coil, to which small scale-pans are appended; and the poles of a horse-shoe magnet of moderate power are inserted within the parallelogram, so as to allow it a moderate range of vibration. The indication of the force of the current is given by the weight in grains supported in the scale-pans. The size and length of the wire of which the coil is constructed may be readily changed to suit varying purposes. The author gives full instructions for the adjustment of the instrument, so that in a certain period it shall indicate one grain in weight for each grain of zinc dissolved in the battery.

2. "On the Action of Baryta on Salicylic Ether," by Mr. G. Baly. This action was described by M. Cahours, but, from his not having continued its investigation, it was taken up by the author. On mixing salicylic ether gradually with baryta, as long as heat continues to be evolved, a dry solid compound is obtained, which, by distillation, yields a brown yellow liquid, consisting of phenol and salithol; the former is separated by a dilute solution of potash, and the salithol purified by washing, drying, and rectification. It is a colourless liquid, having an agreeable aromatic odour; it boils at 444.2° F., and has the formula $C_{16}\,H_{10}\,O_2$. The action of chlorine and bromine on it is briefly alluded to, and the author closes his paper by describing the crystallized compound, dinitrosalithol, formed by acting on salithol with fuming nitric acid. It is insoluble in water, but dissolves in boiling alcohol; its composition appears to be $C_{16}\left\{\begin{matrix} H_8 \\ 2\,N\,O_4 \end{matrix}\right\} O_2$.

3. "Analysis of the Water supplied by the Hampstead Waterworks Company," by John Mitchell, Esq. This water was analyzed as supplied to the houses in the district, and its examination was undertaken with the object of ascertaining its action on lead. No perceptible action on this metal was, however, discovered. It contained about forty grains of solid matter in the imperial gallon, consisting principally of chloride of sodium, with sulphates of soda, lime, and potash, and carbonates of lime and magnesia, with 4.39 cubic inches of free carbonic acid.

ROYAL INSTITUTION.

Probable Friday evening arrangements till Easter, 1849.—

Friday, January 26. Professor Faraday.—On the Crystalline Polarity of Bismuth and other Bodies, and its relation to the Magnetic Force.

Friday, February 2. Professor Brande.—On the Theory and Practice of the Production of Light.

Friday, February 9. Professor Owen.—On the Nature of Limbs.

Friday, February 16. William R. Grove, Esq., V.P.R.S.—On Voltaic Ignition.

Friday, February 23. Rev. J. Barlow, Sec. R.I.—On Mr. Phillips's "Fire Annihilator."

Friday, March 2.—Professor E. Forbes.—On the question, "Have new Species of Organized Beings appeared since the Creation of Man?"

Friday, March 9. B. C. Brodie, Esq.—On the Chemical relations of Wax and Fat.

Friday, March 16. Professor Cowper.—On the Mechanism of Telescopes.

Friday, March 23. Rev. Professor Baden Powell.—On the Nebular Theory.

Friday, March 30. Professor Faraday.—On Plücker's Repulsion of the Optic Axes of Crystals by the Magnetic Poles.

The Friday arrangements at the Royal Institution depend in great measure on the free kindness of eminent men, whose time is subject to the sudden claims of public or professional duty. They are, therefore, liable to change.

JOHN BARLOW, M.A., Sec. R.I.

It is ordered by the committee of managers:—That the doors of the institution be not opened on Friday evenings (except to members) till half-past eight o'clock; and that the five front rows of seats be reserved for members, and for visitors invited by the committee of managers, on Friday evenings, till ten minutes before nine by the theatre clock.

PORTABLE GLUE VERY SOLUBLE IN WARM WATER.—Boil 1 pound of best Russian glue, and strain. Then add ½ pound of brown sugar, and boil thick. When cold, the compound may be poured into small moulds, and afterwards cut into pieces. This glue is very useful to artists for fixing their drawing-paper to the board.

MISCELLANEA.

PATENTS RECENTLY ENROLLED.

George Emmott, of Oldham, in the county of Lancaster, civil engineer, for certain improvements in the manufacture of fuel, and in the construction and arrangement of furnaces, flues, boilers, ovens, and retorts, having for their object the economical application of caloric; the manufacture of gas for illumination; and the consumption of smoke and other gaseous products. Patent dated June 16, 1848. Enrolled December 16, 1848.

The improvements described in this specification relate:—Firstly, to the manufacture of fuel by effecting the carbonization of coals in ovens or retorts, wholly or partially closed, at pleasure, as hereafter described.

Secondly, to certain novel methods which are made use of to render and maintain ovens, used for the carbonization of coals, perfectly or partially air-tight, at pleasure; by which the gaseous products resulting from carbonization are enabled to be consumed, or applied to various useful purposes, thereby effecting a more economical application of caloric, a saving in the amount of fuel consumed in the furnaces beneath the ovens, and at the same time effectually preventing the free escape of dense volumes of opaque smoke to the atmosphere. In ordinary coke ovens, while the process of carbonization is carried on, the whole of the gaseous products are permitted to escape from the top of the oven, or are conveyed through flues to a chimney. To remedy these evils, the patentee employs valves, dampers, hydraulic cups, an exhausting apparatus, fan, blower, or any suitable machinery by which an uniform draught can be regulated. These apparata, or any of them, are attached to the ovens, or to the pipes or flues connected therewith, in such a manner as to prevent the escape of the gaseous products to the atmosphere, and at the same time carry them forward through a series of pipes to a gasometer or receiver, where their various components may be separated; the gas suitable for illumination being purified accordingly is applicable to a variety of useful purposes. So soon (as determined by practice) as the gaseous products evolved are unfit for further useful application, the valves, dampers, or apparatus employed to regulate their admission to the gasometer or receiver are immediately closed; and, opening the ordinary valves and dampers, the carbonizing process goes on in the ordinary manner, until the manufacture of the fuel is complete.

Thirdly. To the combination of a coke oven or retorts, with a steam-boiler (or other vessels used for the purposes of evaporation) under one combined system of furnaces and flues; thus, by fixing a coke oven at the side of, or near to, a steam boiler or other vessel to which heat is applied, and the flues being so arranged in connection with each other, that, so soon as the delivery of the gaseous products to the gasometer or receiver is complete (as mentioned under the second part of the improvements), the heat or caloric resulting from the further carbonization of the fuel in the oven is conveyed by flues beneath, around, or through the steam-boiler, previous to its delivery to the chimney shaft.

Fourthly. To certain novel arrangements in connection with furnaces and flues (as applied to steam-boilers), or other useful purposes, whereby the consumption of the gaseous products evolved by the combustion of fuel in such furnaces is secured, and the nuisance of opaque smoke entirely prevented; an important feature in this smoke-consuming apparatus being, that the furnace can be fired by hand in the ordinary manner, although the patentee gives preference to the more regular method of firing by the machine or hopper. The fire-box of the furnace is furnished with a double set of grate bars, of equal lengths, the front or dead plate being made rather broader than ordinary, and the first or front length of firebars being about one inch in width upon their face, and placed so nearly in contact with each other that the apertures between them will present but a limited space for the admission of air to the fuel. This part of the firebox very nearly resembles a close furnace. The dead plate and front length of firebars are placed upon a horizontal plane, while the second or back length of bars rise from them towards the back of the boiler, with an inclination of at least one and a quarter inches for every foot in the direction of their length. These bars are made very thin, with their upper edges coved or hollowed, and are placed so far asunder as to ensure a liberal supply of common air to this part of the furnace. This second or back length of firebars is fed by means of the firing machine, with that description of fuel known as gas coke, or with the carbonized fuel manufactured in the processes herein described, from its being the carbonized residuum of coals from which carburetted hydrogen, or gas for illumination, has been manufactured; whilst the first or front range of firebars is fed by hand with a fuel consisting of small coals, or of a mixture of coal dust with coal-tar; or of coal-tar, sawdust, ashes, or other combustible substances combined; the gaseous products and opaque smoke given off from these materials being effectually consumed while passing over the heated coke spread upon the second or back length of firebars.

Fifthly. To certain novel arrangements of retorts for the distillation of carburetted hydrogen, or common gas, in connection with the furnaces and flues of steam-boilers and other vessels to which heat is applied for the manufacture of gas for illumination, or for fuel for the furnace fires, as hereafter described, and effectually to consume the smoke and gaseous products evolved by the ignited fuel in the furnaces. For this purpose there is placed a retort, or retorts, made of fire-clay, fire-bricks, or iron, at the side of, or between, steam-boilers, for the purpose of wholly or partially carbonizing the coals, or for manufacturing the gas coke required in the before-described process of consuming the smoke. The gaseous products arising from such carbonization or dry distillation is conveyed by the common modes of gas-making to a gasometer or receiver, as before described; but the gaseous products and caloric resulting from the combustion of the fuel in the furnaces beneath the retorts, instead of being permitted to escape to a chimney, is wholly conveyed, by means of flues at any convenient angle with the side of the boiler, into the fire-box, or into the flues thereof, where the effective application of such products for generating steam, or for other purposes, is secured. The gas collected in the receiver or gasometer is made use of as fuel in the following manner:—At the further end of the fire-box described under the fourth part of improvement, and upon, or near to, the bridge wall thereof, is erected a wall of perforated fire-bricks, or of fire-clay tubes, or fire-clay blocks, perforated with as many orifices or apertures in each as may be necessary. The upper surface of these blocks, or wall of blocks, being raised a few inches above the level of the grate-bars, at the back of the fire-box. Into the apertures of these fire-clay blocks is introduced gas from the gasometer or receiver, which gas, igniting at the orifices on the upper surface of the blocks, forms an entire sheet of flame across the end of the fire-box; and any gaseous products or opaque smoke arising from the combustion of coals or other materials in the furnace coming in contact therewith is effectually and entirely consumed. Having thus explained the particular nature of his improvements, the patentee next proceeds to exemplify their application by the following description:—

In the drawings accompanying the specification, the patentee illustrates his improvements by showing a series of coke-ovens or retorts arranged according to the present improvements. The coke-ovens in which the process of carbonization is carried on are placed back to back, and are fed from the top, by removing the lids, and passing the coals into them through hoppers, until these ovens are duly charged with fuel; fires being previously kindled beneath them in the furnaces, and the heated vapours and gaseous products from such fires following the passage of the flues beneath, around, and above the ovens; it follows that the useful effect of the caloric is thoroughly distributed in making the circuit of the ovens; the gaseous products are thereby effectually consumed, and the delivery of any vaporous matters or opaque smoke from the chimney shaft avoided. So soon as the ovens are sufficiently heated, the carbonizing process takes place, and, in order to secure the valuable products resulting from this dry distillation of the coals contained therein, the lids are closed upon the top of the hoppers, and the hydraulic cups opened, by which means the gaseous matters evolved by the carbonization of the coals in the ovens ascend through pipes, and are conveyed to the gasometer. The purification of the carburetted hydrogen or gas for illumination, its separation from, and the collection of, the residual matters contained in such products being effected in the ordinary manner. To ensure the constant delivery of these gaseous products from the ovens, through the pipes to the gasometer, the patentee employs an exhausting apparatus, of any form or description suited for the purpose, which fan or exhausting apparatus is contained in a cylinder, and is placed in connection with the pipes leading from the ovens to the gasometer, in such a manner that an uniform draught can be maintained thereby, and the supply of the gaseous products from the ovens continue without interruption. This apparatus is driven by means of a strap or band from the shaft of any convenient first mover. So soon as (to be determined by practice) the operator in attendance discovers the product given forth by the carbonization of the coals in the ovens to be unfit for application to any of the before-mentioned purposes, the hydraulic cups should be closed, which is easily effected, by means of chains. The lids on the top of the hoppers, communicating with the ovens, should be partially opened, at discretion, and the carbonizing process carried on in the ordinary manner, until the manufacture of the fuel is complete. As the carbonizing process arrives towards completion, the fires in the furnaces beneath the ovens are slackened from their former intensity of heat, and the lids being open, as before described, a supply of air sufficient to sustain combustion is introduced within the ovens. Placed at the side of the ovens is the steam-boiler; the caloric and gaseous products given forth from the fires in the furnaces, after making the circuit of the flues, is passed under this steam-boiler, through the flues, and thus generates sufficient steam to drive the steam-engine. The doors of the ovens are merely used for the purpose of withdrawing the coke, and for regulating the surface of the coals as introduced from the hoppers, as occasion may require, and thus exposing them thoroughly to the process of carbonization. It being worthy of remark that such manufacture has been effected without the loss or waste of the gaseous matters, and the residuum thereof given forth from the coals; the nuisance of opaque smoke being also avoided. Also that when, instead of the manufacture of fuel, that gas for illumination is the special object in view, then this process and the apparatus employed in connection therewith offer great facilities for obtaining a large supply of gas in a very short time, inasmuch as, owing to the extended surface of the ovens and retorts, the fuel is more thoroughly exposed to the action of the heat, and the distillation of the gaseous products is rendered more perfect than by the methods in ordinary use.

The characteristic features of this invention is, that no waste of coals, or the products resulting from the combustion or carbonization thereof, or of the caloric contained therein, is permitted to take place; but that the whole of these products are retained, and applied to a variety of useful purposes, as described.

The patentee claims—First. The manufac-

ture of fuel by the carbonization of coals in ovens or retorts, opened or closed at convenience, as described.

Secondly. The recovery of the gaseous products evolved by such carbonization, which are ordinarily wasted ; and the methods of effecting the application of such products as gas, suitable for the purposes of illumination ; or for imparting caloric to ovens, steam-boilers, and other vessels or apparatus requiring heat, as also the application of the residuum of such products to various useful purposes.

Third. The combination of a coke-oven or retort, and steam-boiler, or other vessels used for the purposes of evaporation, under one common system of furnaces and flues.

Fourth. The arrangements as described, or any mere modification of the same, whereby the smoke and other gaseous products resulting from the combustion of fuel in the furnaces of steam-boilers, and other vessels or apparatus, is effectually consumed.

Fifth. The introduction of carburetted hydrogen or common gas within the fire-box or furnaces of steam-boilers, or other vessels or apparatus, and effecting the combustion of the same at the back of the fire-bars, near to, or upon, the bridge of such furnaces, or in any other position or place therein, whereby the smoke and gaseous products given forth from the ignited fuel is effectually consumed by the combustion of such carburetted hydrogen or common gas.

Sixth. The arrangements as described, or any mere modification thereof, by which the manufacture of carburetted hydrogen, or gas for illumination, is carried on by means of retorts in connection with the furnaces and flues of steam-boilers, or other vessels or apparatus.

William Edward Newton, of Chancery-lane, Middlesex, for improvements in the construction of stoves, grates, furnaces, or fire-places for various useful purposes. Patent dated July 6, 1848. Enrolled Jan. 6, 1849.

This specification describes certain improvements in the construction of stoves, and other descriptions of closed furnaces; and is communicated to the patentee by the inventor, who is residing abroad.

The object of these improvements is the more perfect development of the heat produced by the combustion of fuel, and the prevention of smoke, by consuming it in combination with atmospheric air. Drawings accompany the specification, which illustrate the application of the improvements to heating stoves, as also to those employed for culinary purposes. The fire-place or chamber, wherein the fuel is consumed, being either completely surrounded by an outer case, thereby forming a chamber, within which the atmospheric air is heated, or only partially closed, leaving the front of the fire exposed. In either case means are provided for replenishing the fire when necessary, by supplying the heated chamber (which surrounds the fire-place) with fuel. The atmospheric air passes from without through holes in the sides, the quantity of air so admitted being regulated by means of registers over the holes. The outer case enclosing the fire-place is not the outside case or shell of the stove ; there being another, partially enclosing both the fire-place and the case immediately surrounding it ; this case being designed and ornamented in any tasteful manner. Above the portion of the stove just described another chamber is constructed, into which the products of the combustion in the fire-place, and the heated atmospheric air from the chamber surrounding the fire-place, are conveyed, by means of a conical-shaped pipe, which the patentee denominates a throat; the area of this throat at the lower end, where it is connected to the fire-place, is of greater extent than the upper end, which passes through the plate, dividing the lower portion of the stove from the upper chamber; the inflammable matters, products of the combustion in the fire-place, pass through this throat from the fire-place to the upper chamber (called by the patentee the heating chamber), at the same time the heated air in the chamber, surrounding the fire-place, is also passed into the throat at its lowest part, and consequently ensures an admixture of the heated atmospheric air with the inflammable products from the fire-place. The heated products pass and circulate around the interior of the upper chamber (by which it is thoroughly heated), and then passes downwards through a vertical pipe, into the outer chamber of the lower part of the stove, by which the external case of it is heated. From this chamber the heated air and products pass, by a pipe, to the chimney or other outlet ; the heated air from the chamber immediately surrounding the fire-place, in passing into the throat, intimately mixes with the inflammable products from the fire-place, and is thereby consumed. The improvements may be applied to stoves to be employed for culinary purposes ; ovens, boilers, and other conveniences ; being so placed as to project into the chambers, both in the upper part as well as in the lower. The patentee states that the improvements are also applicable to furnaces to be employed for the purpose of puddling and making iron. The atmospheric air may be admitted to the throat direct from without, in its natural state of temperature, instead of passing it to the chamber, and thereby heating it. He also states that steam, as well as the atmospheric air, may be admitted to the throat ; the mode also of supplying the atmospheric air to the throat may be varied, as it may be admitted at the sides by several openings, or by one opening, or in the middle of the throat; the object being to intimately mix the atmospheric air and the inflammable matters from the fire-place together ; the throat may also be increased in size between the upper and lower apertures, for the purpose of giving longer time for the air and products to mix, previous to passing into the heating-chamber.

The patentee claims :—First, the combining the chamber of combustion (in which the fuel is consumed) with a heating-chamber, for the combustion and circulation of the inflammable matters evolved from the combustion of the fuel, by means of a throat, through which such products of combustion pass.

Secondly, the admitting atmospheric air into the throat, through which the products of combustion pass, for the purpose of combining with such.

Thirdly, the forming the lower aperture of the throat larger than the upper aperture, for the better combination of the air and the products of combustion.

Fourthly, the forming the throat of an enlarged size between the lower and the upper aperture.

Joseph Clinton Robertson, of Fleet-street, London, civil engineer, for improvements in the manufacture of gas. Patent dated July 6, 1848. Enrolled January 6, 1849.

This specification describes improvements in the production of gas for illumination, in the production of oleaginous matters during the process, in the production of an anti-friction grease, and in the production of a spirit. The first of these productions is obtained from resin combined with potash and lime, or potash, soda, and lime, or any one or more of these substances. This combination is placed within a case, one end of which is closed by a cover in a perfectly tight manner, the other end being closed by a cover in such manner that by the exercise of a slight internal pressure in the case the cover shall be removed or blown off from the case. When the case shall have been charged with the combination, it is then placed within a retort, set in a furnace in the ordinary manner, and submitted to a cherry-red heat. The volatile products of this distillation is then passed through other retorts similiarly set, and which contain lumps of coke, broken brick, or other similar materials. The number of retorts being one, two, three, or more, depending upon the required purity of the gaseous products, which, after being passed through a wash-vessel and purified, is delivered into a gasometer of the ordinary construction.

When it is required to obtain the oleaginous matters contained in the products of the first distillation, such products are passed from the retort in which they are produced into vessels containing water, by which the oleaginous matters are separated from the volatile matters. The patentee obtains from these oleaginous matters an anti-friction grease, for lubricating the working parts of machinery and other similar purposes ; as also from the same volatile products he obtains a spirit, to be used as a varnish or vehicle for colours by applying heat, taking care that it shall not be too great.

He claims, first, the manufacturing gas for illumination from resin combined with alkaline and vegetable fibrous substances, and subjecting them to heat in a retort; and then passing the volatile or gaseous products of this distillation through other retorts (one, two, or three) containing lumps of coke, broken bricks, or other similar substances in a fragmental and incandescent state.

Secondly. The separation and collection of oil or oleaginous matters from the volatile or gaseous products of the first distillation of the above combination.

Thirdly. The manufacture from the oil or oleaginous matters of an anti-friction grease.

Fourthly. The manufacture of a spirit from the above-described products.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING JANUARY 11, 1849.

John Coope Haddan, of 29, Bloomsbury-square, civil engineer, for an improvement or improvements in railway wheels. Patent dated January 1849 ; six months.

Miles Wrigley, of Ashton-under-Lyne, architect, for certain improvements in the manufacture of yeast or barm. Patent dated January 11, 1849 ; six months.

William Henry Newton, of Chancery-lane, civil engineer, for a certain improvement or improvements in the construction of wheels. Patent dated January 11, 1849; six months.—(Communication.)

James Castley, of Harpenden, in the county of Hertford, manufacturing chemist, for improvements in the manufacture of varnishes from resinous substances. Patent dated January 11, 1849 ; six months.

Robert Urwin, of Ashford, in the county of Kent, engineer, for certain improvements in steam-engines, which may, in whole or in part, be applicable to pumps and other machines not worked by steam power. Pated dated January 11, 1849 ; six months.

Obed Blake, of the Thames Plate Glass Company, residing at 13, Southampton-street, Strand, gentleman, for certain improvements in ventilating ; or ventilators for ships, vehicles, houses, or other buildings. Patent dated January 11, 1849 ; six months.

Francis Hobler, of Bucklersbury, in the city of London, gentleman, for improvements in the construction of the cylinders or barrels of capstans and windlasses. Patent dated January 11, 1849 ; six months.

Michael Loam, of Treskerley, Cornwall, engineer, for improvements in the manufacture of fuzees. Patent dated January 11, 1849 ; six months.

Christopher Nickels, of the Albany-road, Surrey, gentleman, for improvements in preparing and manufacturing indiarubber (caoutchouc). Patent dated January 11, 1849 ; six months.

William Rowe, of New Wharf, Whitefriars, in the city of London, carpenter and joiner, for certain improvements in the mode of uniting or combining pipes, or lengths of pipes, tubes, or channels formed of glass, earthenware, or other similar material. Patent dated January 11, 1849 ; six months.

William Walker, of Manchester, agent, for certain improvements in machinery or apparatus for cleaning roads or ways, which improvements

are also applicable to other similar purposes; six months.

PATENT RECENTLY EXPIRED.

A. Smith, of Middlesex, engineer, for a new standing rigging for ships and vessels, and a new method of fitting and using it. Patent dated January 12, 1845; expired January 12, 1849.

SUGAR IN RUSSIA.

The following is a decision on the sugar question which has just been issued by the Russian Government, ordering a reduction in the duty on yellow sugars of sixty copecs per pood or 5s. 6d. per cwt.:—

"St. Petersburg, Jan., 1849.

"His Majesty, having examined the different opinions in the committee of Ministers about the admission of white and yellow sugars at a differential duty, has given the following decision:—

"1. Having divided the raw sugar imported in St. Petersburg from abroad into two categories, to refer to the former the white sugar, and to the second the yellow and brown sorts.

"2. White sugars are to be admitted as hitherto, at a duty of 3 ro. 80 cop. silver per pood, whereas yellows and browns, which will prove similar or inferior to the standard sample, pay only 3 ro. 20 cop. silver (by way of a trial for three years). If they are higher than these samples, however, they must pay the duty of whites.

"3. This law is to be in force from the navigation 1849; and to be likewise applied to the yellow sugars remaining then uncleared in the custom-house of the importation of 1848.

"4. The standard sample will be fixed by the United Committees of Manufactures and Commerce, and confirmed by the Minister of Finances, and a set of them kept in each of the two, and in the department of foreign trade. The sample fixed upon in this instance of the different qualities received from abroad is the one of a rather darker tint, to be chosen by the committees and to be confirmed by the Minister of Finances.

"5. An attestation on stamp of three experts, named for that purpose, must accompany each parcel of sugar cleared at the custom-house, as belonging to the second category.

"6. If sugars declared as yellows are not admitted as such by the experts, they only pay the duty of white sugars, and are not passive of the penalty of 1½ duty, levied for the declaring of higher goods as belonging to a lower description.

"7. The experts are appointed for one year. Two are chosen out of the merchants and brokers, and one out of the members of the Moscow Economical Society of the Committee of Sugar Refiners.

"8. If there is any difference of opinion amongst the experts, they refer in writing to the Exchange Committee, which gives its opinions to the custom-house. If the custom-house, however, does not agree with the same, the case is referred to the department of foreign trade.

"9. The remuneration to the experts is 1 cop. silver per pood on the whole importation of sugar."

EFFECTS OF THE USE OF ARSENIC IN AGRICULTURE.

POISONED GAME.

Dr. Fuller, of St. George's Hospital, has recently called attention to the probable injurious effects resulting from the use of arsenic in steeping seed corn:—

"For some months past (says Dr. Fuller), in certain parts of Hampshire, partridges have been found dead in the fields, presenting a very remarkable appearance. Instead of lying prostrate on their side, as is usually the case with dead birds, they have been found sitting with their heads erect and their eyes open, presenting all the semblance of life. This peculiarity, which for some time had attracted considerable attention among sportsmen in the neighbourhood, led to no practical result until about ten days ago, when a covey of ten birds having been found nestled together in this condition, two of the birds, together with the seeds taken from the crops of the remaining eight, were sent up to London for examination. I was requested to undertake the investigation, and the result of my experiments I will now briefly detail.

"I first examined the seeds taken from the crops of the birds, and detected, as I anticipated, a large quantity of arsenic.

"I now, at the suggestion of my friend Mr. Stone, proceeded to ascertain whether the flesh of birds so poisoned might not itself prove poisonous when eaten, and with this view I carefully cut the flesh off the breast and legs of one of the birds, and gave it, together with the liver, to a fine healthy cat. She ate it with avidity, but in about half an hour she began to vomit, and vomited almost incessantly for nearly twelve hours, during the whole of which time she evidently suffered excessive pain. After this nothing would induce her to eat any more partridge. I kept her without food for twenty-four hours, but in vain; she resolutely refused to touch an atom more of the bird. This being the case, I gave her some beef and some milk, which she eagerly swallowed, proving beyond doubt that her instinct, and not her want of appetite, induced her to forego the dainty meal which had just been offered her.

"I now felt satisfied, from my observation of the symptoms induced in the cat, borne out as they were by many facts we are acquainted with respecting the action of poisons, that the arsenic which the partridges had swallowed had been absorbed in sufficient quantity into the system to render the flesh of the birds poisonous, and to induce poisonous effects in any one partaking of it. However, I was anxious to leave nothing to hypothesis, and as the cat had so soon rejected by vomiting the greater part of the bird she had eaten, and pertinaciously refused to repeat the experiment by again partaking of the poisoned food, I was obliged to have recourse to chemical analysis, with the view of ascertaining with certainty the existence or non-existence of arsenic in the flesh itself. I therefore cut the flesh off one side of the breast of the other partridge, and, after about an hour's boiling, I obtained by Reinsch's process a thin incrustation of metallic arsenic, thus demonstrating beyond question what the previous experiments had left little room for doubting."

Dr. Fuller ascribes the poisoning of the game to their having eaten the seed-corn which had been steeped in a solution of arsenic; and he very justly observes:—

"It is notorious that many of the dealers in game are supplied through the agency of poachers and others who have a direct pecuniary interest in supplying them with the largest possible number of birds. It is certain, moreover, that if men of this sort were to find a covey of partridges in a field, dead, but fresh and in good condition, they would not hesitate to send them with the remainder of their booty to the poulterer, who would as certainly, without suspicion, sell them to his customers. And, after the experiments above detailed, there can be no reasonable grounds for doubting that these birds, when eaten, would produce disagreeable and injurious—not to say poisonous—effects on those who partake of them. It is obvious, therefore, that in all cases of supposed cholera, or of suspicious bellyach, occurring at this season of the year, we shall do well to make particular inquiry as to whether our patient has recently partaken of pheasants or partridges purchased at a poulterer's; and it is further manifest that, in all cases of poisoning or suspected poisoning by arsenic, the fact of the persons having lately eaten of partridges and pheasants must form an important element in the inquiry, and must tend to cast a suspicion on the evidence adduced to prove a criminal intent on the administration of the poison. So that, in a medico-legal point of view, the question is one of the gravest import."

MR. HOOPER'S EXPLANATION.

At Guildhall, on Friday, the 12th inst., Mr. Hooper, the chemist and druggist residing by London-bridge, appeared before Sir G. Carroll under the following circumstances:—

On Monday week Mr. M'Dougell, surgeon, made an application to the sitting alderman for his advice, and stated that, having a patient from the country placed under his care, he, in the course of his professional attendance, considered it necessary to give a double dose of medicine of a sedative character, the prescription of which he wrote, directing that it should be taken at bedtime. It was sent to Mr. Hooper's, and one of the assistants, instead of using camphorated water and henbane, made the mixture up of henbane, opium, and spirits, and, had it been taken, his patient would have been killed; but the most fortunate circumstance was, that the assistant made a further mistake by writing on the bottle the word "Mixture," instead of "The draught; to be taken at bedtime," in consequence of which it was not taken. On calling twice he could not see Mr. Hooper, and the assistants treated the affair with great levity, saying that it was "only a mistake."

The alderman granted a summons for ignorance or wilful negligence in allowing the prescription to be made up.

Mr. Wire attended, and said that Mr. Hooper, who was then present, appeared, not to defend the summons, but to clear his own character. An explanation of the facts of the case had been given to Mr. M'Dougell, and he was perfectly satisfied; but, as a report of the application had appeared in the newspapers, it was necessary that an explanation should be as publicly given. Mr. Hooper's mode of conducting business was this—that if he should not happen to be at home to make up a prescription his assistants were not to do so, but to send it to a neighbouring chemist. In this instance one of them had departed from that rule, and it was with deep regret that Mr. Hooper was obliged to say so. However, he had taken precautions that, for the future, it should not occur again. With respect to Mr. M'Dougell having called twice, and been told that Mr. Hooper was not within, that gentleman was perfectly ignorant of the whole affair until he received the summons, and he had every reason to believe that on each occasion the assistant had denied him for the purpose of screening himself. Under all the circumstances, he (Mr. Wire) thought there was no occasion to trouble the alderman with going into evidence which might eventually turn out to be not within his power of deciding.

Sir G. Carroll asked if the complainant was satisfied after hearing Mr. Wire's explanation?

Mr. M'Dougell said he was. His only object in summoning Mr. Hooper was to further the object which the medical profession generally were exerting themselves for, and compel chemists and druggists to undergo an examination, and also that their assistants should pass through the same ordeal. It was true that a Pharmaceutical Society existed which had a great number of members; but the fault was, that they had no act of Parliament, and therefore examinations were not compulsory. On the last occasion he made a slight error in stating that the bottle was a two-ounce one, whereas it would only contain one ounce and a half, and therefore there could be but an ounce of paregoric.

Sir G. Carroll: Would that quantity have had the same effect?

Mr. M'Dougell: The effect would have been the same, but I am now perfectly satisfied with the explanation given.

The chief clerk intimated to the alderman that the assistant was already dismissed from Mr. Hooper's service.

Sir G. Carroll said the public were much in-

debted to Mr. M'Dougell for calling the magistrate's attention to so serious a subject, where the lives of so many were at the mercy of such persons. Mr. Hooper, he thought, had given a very satisfactory explanation through his legal adviser, and therefore the summons was dismissed.

ILLEGIBLE PRESCRIPTIONS.

[To the Editor of the *Times*.]

Sir,—It is gratifying to observe that a portion of your columns is devoted to the deprecation of social nuisances, such as street-begging. Suffer me to point out another. Your police report detailed a case a few days ago in which a medical practitioner deemed it his duty to call the attention of the chief magistrate of the City to the carelessness or incompetency of a retail druggist's assistant, who had incorrectly compounded a prescription. Into the merits of that inquiry I do not wish to enter; but I strongly wish, through your columns, which have given such extended publicity to that circumstance, to advert to another wanton and serious evil, prevalent, I believe, far more extensively and dangerously in London than in the provinces. I allude to the illegible scrawl adopted by many among the host of men who write prescriptions. I can only regard it as silly affectation to write, in characters often to be deciphered only by guess, formulæ upon the incorrect reading of which may depend the life or death of a patient.

Sir, I speak advisedly, and, however necessary it may be that the retail dispenser should be thoroughly qualified by preliminary education and examination for his important duties, no valid reason can be assigned why the possible chance of danger should be enhanced by requiring him to dispense from hieroglyphical characters, requiring several minutes' study before they can be read with certainty. During my professional life I have seen some thousands of prescriptions written by all classes of medical men; but I am free to say that in London, especially, it has often been my accidental lot to meet with them on the counters of dispensers who have smilingly felicitated themselves on the fact that, from a knowledge of the peculiar caeography, they alone have been able to monopolize that person's prescriptions. Be as severe as you will on incompetent dispensers; but surely the man of business who writes his name in a hand that cannot be read commits an affront on his common sense not half so silly, and incomparably less dangerous and reprehensible, than the hasty scrawler of an abbreviated and illegible Latin prescription.

It is of no use forwarding this communication to the medical periodicals. Those who offend in this particular will never amend the practice until shamed out of it by public opinion and the popular daily press.

I am, sir, your obedient servant,

London, Jan. 15. A CHEMIST.

PLASTER MOULDS FOR CASTING WAX.—Wax figures and ornaments may be cast by modelling a shape of what is wanted. A basket, or anything that projects, must be made in several pieces, but if round or square it may be made in one. Oil the parts of the model all over; mix plaster of Paris, well burnt and sifted fine, into a thick paste, as thick as gum-water; lay it on one side of the surface of the model, but not over anything that projects, or it will not come off the model. When dry, which will be in a few minutes, scrape it, and mark the piece by cutting holes in at the sides, then oil it well, and then lay on another surface more plaster as before, mixed fresh, and so continue till the whole model is covered all over. When dry it will come to pieces; take the model out, and tie it together, leaving an aperture for pouring in the wax; great care must be taken of the extremities, for if not properly cast they will never come out of the mould. *Flat Moulds.*—Lay the subject that is to be cast on a marble or glass slab; make a wall round it with wax. Oil the patterns, such as borders, stars, and patties, as well as the slab. Mix plaster of Paris with water, to the consistence of thick cream, and pour it gently over the patterns, till covered over two inches thick. When perfectly dry, which will be in half an hour, remove the wall, and take up the mould; oil it, and dry it well before using.

METROPOLITAN AND CITY SEWERS.—The two new acts relative to the metropolitan and city sewers are now in operation. The City Sewers Act, which contains 266 clauses, came into operation on the 1st inst., and the Metropolitan Sewers Act (11th and 12th Victoria, c. 112), containing 149 provisions, came into force a few days back under a consolidated commission dated the 1st inst., and on Tuesday the second court was held for the transaction of public business. The Lord Mayor and four other commissioners of the city of London are to act under the metropolitan commission on questions affecting the city; which questions are to be discussed at special courts, of which notice is to be given. The new act extends to twelve miles from St. Paul's-churchyard every-way except the city; whilst the new act for the city has authority within the city and liberties thereof. A book has been opened at the principal office in Greek-street, and at several branch offices, for complaints whether made orally or by letter, and the applications are to be answered.

MUSHROOMS.—To know good from bad it is necessary to be very cautious in selecting mushrooms, as more of them are poisonous than wholesome. The wholesome ones commonly used are pink in the gills, and white above, small and compact; the bad ones are black or brown in the gills and more broad. Poisonous mushrooms usually grow in wet shady places, have a nauseous odour, and are soft, open, and porous, with their surface gaudily coloured or dirty-looking, and the stalks soft and bulbous. They grow rapidly and soon decay. When taken, poisonous mushrooms exhibit symptoms of nausea and retching, colic, purging, thirst, fainting, stupor, delirium, cold sweats, convulsions, and frequently death. The best treatment consists in administering an emetic of sulphate of copper or zinc, or of potassio-tartrate of antimony, following it up with saline purgatives, such as the black draught, and clysters of the same. If there be much sinking of the nervous system, hot brandy and water, camphorated mixtures, ether, and other stimulants, also the warm bath, are proper to be used.

HUILE ANTIQUE AU MUSC.—Pound in a glass mortar 1 drachm of musk with 4 grains of amber, adding gradually, by little and little during the process, 8 ounces of oil of ben. When they are well mixed, put the mixture into a small bottle, and, to take up every particle of the musk and amber, put into the mortar 4 ounces of fresh oil of ben, which is also to be put into the same bottle. Leave the whole for twelve or fourteen days in a warm place, shaking it every day. Leave it then to rest for one day more, pour off the oil clear, and preserve it in small bottles well corked for use. In the same manner may be made Huile Antique à l'Ambre, by changing the proportions of the amber and the musk.

HUILE ANTIQUE A L'ORANGE.—With 1 pound of oil of ben mix 3 ounces of essential oil of orange, and put it into small bottles, well corked, with wax over them to preserve it from the air, and prevent the perfume of the orange oil from evaporating.

ARTIFICIAL ASSES MILK.—Long experience has demonstrated that for certain purposes the milk of the ass really possesses an efficacy which cows' milk is devoid of. When not procurable it may be imitated as follows:—Boil in 3 pints of water till half wasted 1 ounce of each of eryngo-root, pearl barley, sago, and rice; strain, and put a teaspoonful of the mixture into a coffee-cupful of boiling milk, so as to render it of the consistence of cream. Sweeten it with sugar or honey to taste.

TO CORRESPONDENTS.

SEWAGE MANURES.—"A Constant Reader" (of Leeds), whose query regarding the disposal of sewage manures we inserted in No. 123, may receive some important information on that subject from Mr. William Higgs, of 69, Lillington-street, Vauxhall-road.

"Mr. Charles Bowden" tells us that the formula for the elixir of Garus which we gave in our number of last week is very incorrect indeed. The proportions, according to our correspondent, should be—Aloes and saffron, 2 parts of each; myrrh, cinnamon, cloves, and nutmeg, 1 part of each; orange-flower-water, 18 parts; alcohol, 500 parts; syrup of capillaire, 320 parts. Is our correspondent aware that there is no fixed and immutable formula for the preparation of the elixir? In France every apothecary has a formula of his own. The following, for instance, is the receipt of M. Thierry, one of the most distinguished pharmaciens in France:—

Take of Aloes,
Myrrh,
Saffron, of each 1 part.
Nutmeg, 2 parts.
Clover,
Cinnamon, of each 4 parts.
Alcohol of 80 Cent., 700 parts.

Digest for two days; and distil off 640 parts.

Add now to the residue 500 parts of rose-water. Distil off 320 parts, and add of the distillate to the product of the first distillation a sufficiency to reduce the latter to 67 per cent.

Take now of this Aromatic mixture, 36 parts.
White sugar syrup, 50 parts.
Tincture of vanilla,
Fresh orange-peel, of each 1 part.
Fresh milk, 2 parts.
Tincture of saffron, a sufficiency to impart the proper colour to the product.

Mix, let the mixture stand at rest for two days, and filter.

We hope our correspondent will in future endeavour to make himself somewhat better acquainted with the subject before he ventures to impugn the accuracy of our receipts.

"Mr. W. Rolland, of Liverpool."—We think the article on electric light (by Mr. W. Maugham) will be found in the "Nautical Magazine" of 1833 or 1834.

"Mr. Sharpe."—We are greatly obliged to you, but must decline for the present.

"T. G. S."—We are not sufficiently acquainted with the circumstances of the case to proffer our advice. The subject is a delicate one.

"Mr. W. R. White."—We have not yet received the samples; as soon as they come to hand we will attend to your wishes.

"Mr. Robertson."—We think Fresenius's "Qualitative Analysis" will answer your purpose best.

"A Victim of Fraud."—The sample of olive oil which you have sent us contains a slight admixture of poppy oil, but to the utmost about four per cent. only, and not fifty per cent., as you state you were informed by a chemical friend of yours.

"A Chemist."—Wheeler's process of preparing chlorate of baryta is as follows:—Digest for a few minutes a concentrated solution of chlorate of potassa with a slight excess of silicated hydrofluoric acid. A precipitate of double fluoride of silicate and potassium will subside, and chloric acid remain in solution. Filter; neutralize the filtrate with carbonate of baryta; filter again, and evaporate the filtrate cautiously: prismatic crystals of chlorate of baryta will be deposited.

"A Teadealer."—The Chinese prepare the sheet-lead intended to encase the tea in the following way:—Melted lead is poured from a crucible upon a large flat stone, placed upon the ground; another stone of equal size is then dashed upon the fluid lead and pressed down forcibly. By this means the lead is pressed out into a very thin leaf, which is then at once removed from the stone, and the operation repeated with the greatest possible rapidity. The rough edges of the plates are subsequently cut off, and the plates soldered together for use. The process requires two men; the one to pour on the melted lead, and the other to work the stones.

"A Student of Chemistry."—Chevreul was the discoverer of capric acid and caproic acid, not Dumas.

"Analyst."—You forget the six atoms of basic water. Add these, and you will find the calculation perfectly correct.

"Mr. Johnson."—One part of concentrated sulphuric acid to three parts of water.

"A Druggist."—We will endeavour to obtain the required information for you.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—January 20, 1849.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 85.]

Experiments accurately conducted and frequently repeated have demonstrated the fact, that animal charcoal effects its maximum amount of decoloration on sugar solutions when the latter possess a density of about 27 or 28 of Beaumé's scale; when they are free from much animal impurities; and when they are heated to about 100° of Fahrenheit.

In the refinery these three conditions are well fulfilled; in the colonies the reverse is the case, as on examination we shall not fail to recognise. In some cases the colonial sugar-producer has tried the employment of charcoal on the juice recently expressed, sometimes after defecation with lime, sometimes without any preparation whatever. In either case the result has been a signal failure, as might easily have been predicted. The non-defecated juice speedily runs into fermentation, on account of the impurities it contains, and the defecated juice is but slightly better in this respect—both fatal objections to the plan: in addition to which, two of the three conditions under which charcoal produces its maximum effect are violated.

Other colonial sugar-producers have imitated the refiner in boiling down the defecated juice to a density of 28° of Beaumé, and then filtering it. Under these circumstances the resulting filtrate or liquor which percolates through the charcoal is rendered very pure; but, in consequence of the great amount of mucilaginous and other impurities which the charcoal is thus made to separate, it very soon loses both its chemical and its mechanical effects; these, apart from some other grave objections, such as the time occupied, the chance of fermentation during the process, &c., the very expense of frequently changing and reburning the charcoal, would be a great, often an insuperable, bar to the general employment of the process.

As to the vacuum-pan, I believe it is destined before long to supersede every other plan of evaporation for sugar solution, and still I am satisfied that its colonial use hitherto—I mean for the preparation of muscovado sugars—has been attended on the whole with more loss and disappointments than gain and satisfaction; and this simply because no plan has been hitherto applied of preparing economically a sacchumic juice sufficiently pure to be submitted to the agency of this instrument with advantage. It may be laid down as a safe affirmative proposition, that in direct proportion as a liquor to be boiled is charged with impurities, and throws up scum, so is it unadapted for vacuum-pan treatment. The reason of this is evident, when we consider that, the vacuum-pan being a closed vessel, whatever impurities are eliminated by boiling must be necessarily admixed with the resulting sugar, no means of removing it being possible.

Now, hitherto, the colonial sugar-producer has been unable (except on certain picked estates) to obtain without the use of charcoal a liquor sufficiently pure to boil without throwing up a scum, and the difficulties attendant upon the colonial use of charcoal have been already stated. Whilst thus most fully alive to the beneficial agency of animal charcoal, and the vacuum-pan, when and under the proper circumstances, I reiterate, as the result of a prolonged study of the manufacture of sugar, both in the laboratory and in the refinery, on solutions of muscovado sugar, of the cane, and the date, as well as upon natural sugar containing juices, that the employment of the vacuum-pan and of animal charcoal in the colonial operation will be in a manner thrown away until some method shall be devised of sufficiently defecating the juice by a preliminary operation, for the purpose of securing all the conditions which have been propounded as necessary to the desired result,—a desideratum which it is possible will be speedily achieved.

I will, therefore, defer all further notice of the vacuum-pan and of animal charcoal until the period when I shall have to treat of refineries, and will revert to the stage of the sugar-producing operation, wherein the produce had at length become partially crystallized.

If a chemist were desirous of obtaining his maximum amount of sugar, or any other crystalline substance, out of a solution, he would have recourse to some plan of effecting perfect drainage. He would never dream of either deceiving himself or the public by weighing his crystalline produce mixed with mother liquor and attendant impurities, and considering the aggregate weight as sugar. He would drain thoroughly, I repeat, and would carefully re-evaporate his drained liquor, and would thus proceed until the whole of his crystalline produce had been obtained. It is objected that the mother liquor of drainage may be supposed to be so impure that it would not pay for re-evaporation. The answer is plain: if too impure for the treatment indicated, it is also too impure for admixture with a pure material; and its attempted introduction thus mixed into commerce is neither more nor less than a deceit.

The British colonial sugar-manufacturer violates the chemical conditions, and employs the argument which I have first adverted to and repudiated. He violates every law of crystallization, and pours his half-granulated sugar, as I have mentioned, into shallow tanks, where it may rapidly cool.

When accreted to a certain extent the half-crystalline pasty mass is removed by buckets into casks with perforated bottoms, each hole being plugged by the stem of a plantain leaf, and thus it is allowed to drain.

As may be well imagined, this process of drainage is tedious, and most imperfect, so much so, indeed, that expensive instruments called pneumatic-chests are sometimes employed for the purpose of removing the molasses or liquor of crystallization by suction,—a process which, if the sugar had been properly crystallized, would have been totally unnecessary, and which performed on an ill-crystallized sugar is most wasteful and inefficient.

With the production of this ill-crystallized material the operation of sugar production in the British colonies may be said to end. In the colonies of certain other nations, however, particularly in those of Spain, Portugal, as well as in the tropical regions formerly subjected to these powers, another operation, called that of claying, is superadded, the object of which is the production of a sugar more light in colour and drier than muscovado, and prepared by subjecting the latter to a final operation of ablution.

This is conducted as follows:—The sugar having been allowed to crystallize in conical moulds, instead of shallow trays, each mould having an orifice in its apex stopped by a plug, the plug is removed, and the mother liquor of crystallization is allowed to drain away, leaving a yellow or muscovado sugar, which is merely white or pure sugar plus impurities in the mould. On the base of this conical mould is now superimposed a thin layer of magma, prepared by beating up white clay with water. Thus situated, the clay magma yields up its water by degrees, and which, percolating downwards, carries before it a large amount of colouring material, and so much sugar, leaving the residue more or less white.

In the refinery this final purification by percolation is very efficiently carried out, and with the result of making white sugar, which, in point of fact, cannot be otherwise produced; but the preceding stages of colonial sugar manufacture must have been barbarous, indeed, if, after the percolating operation, the result be only a yellow material. As conducted in Cuba and the Brazils, at least one third of the crystallized muscovado is washed away by the process of claying, and six weeks are consumed. The resulting sugar is light in colour, it is true; but, had the preliminary operation of defecation been well conducted, it might have been produced better in colour and better in grain, merely after spontaneous drainage, and without any claying whatever.

It is to be regretted that this claying operation opens the door to much charlatanry and deceit. Sugars of light colour are frequently exhibited as a triumph of some particular plan of manufacture, whereas, on examination, it will be found that this very colour, their only good quality, is solely due to a final process of claying, which, reckless of loss and other expense, accomplishes the removal of impurities that never ought to have been generated.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLII.

(LECTURE LXX.)

EXTRACTIVE.

SECTION I.—BITTER EXTRACTIVE.

B.—BITTER ROOTS—(*continued*).

GENTIAN.

(From Gentiana lutea, G. rubra, G. purpurea.)

The root of the gentian enjoys considerable reputation as a tonic, febrifuge, and anthelmintic.

It has been carefully analyzed by Planche, Henry and Caventou, Leconte, and other chemists.

It contains:—

A volatile odorous principle,
Gentisin,
Birdlime,
A greenish oily matter,
Uncrystallizable sugar,
Gum,
Pectic acid,
A pale yellowish red colouring matter,
Some organic acid.

Planche found in the root of the gentian a peculiar volatile principle which imparts to the distilled water of gentian nauseating and slightly intoxicating properties. Most of the preparations of gentian, however, contain this principle in too feeble proportions to permit its action making itself felt.

Henry and Caventou, who were the first to extract the crystalline matter, obtained it only in an impure state. They considered it to be the bitter principle of gentian, and called it, accordingly, *Gentianin*. But Leconte and Trommsdorf have discovered since that the crystalline matter is simply a colouring principle, perfectly free from all bitter taste, and that the so-called gentianin consists of a mixture in variable proportions of this colouring principle, the bitter principle, and fatty matters.

The name "Gentisin" has been assigned to this crystalline colouring matter of the gentian.

Gentisin has a pale yellow colour; it is tasteless and inodorous; it crystallizes in long needles. At a high temperature it suffers partial decomposition; a portion of it, however, volatilizes unaltered, and recondenses subsequently in crystalline needles. It is very sparingly soluble in water, and more readily in hot than in cold alcohol; from its solutions in hot alcohol it recrystallizes on cooling. It is but sparingly soluble in ether, but dissolves largely in concentrated solutions of caustic alkalis, with which latter it forms true salts (Gentisates). It does not decompose carbonates.

Gentisin is prepared as follows:—Macerate dried and coarsely-pounded gentian-root in alcohol of 95 C., and repeat the operation with fresh portions of alcohol until the latter ceases to acquire the slightest yellow tint from the

gentian. Filter the liquids and distil. Treat the residuary extract with water, which will remove the bitter extractive matter, the free acid, and the sugar, and leave, in the form of white flakes, the fatty matter in conjunction with the gentisin. Collect this flocculent residue, wash and dry it, and treat it with boiling alcohol of 78 C., which dissolves the yellow crystalline principle, and leaves the fatty matter almost intact. The gentisin will subsequently crystallize from the alcoholic solution on cooling, and by spontaneous evaporation; should it still retain traces of oil, these may be removed with a little ether. The gentisin is then to be redissolved in boiling alcohol of 78 C., and from this solution it will finally crystallize in perfectly pure, well-formed, yellow crystals.

The properties of the bitter principle of gentian are but little known as yet. M. Leconte obtained it as an extractive, uncrystallizable, matter, exceedingly soluble in water and in alcohol.

With regard to the matter known by the name of birdlime, M. Leconte has demonstrated that it is a compound of wax, oil, and caoutchouc.

POWDER OF GENTIAN-ROOT.

Cut the root of the gentian in slices, dry in the stove, and reduce to powder, without leaving hardly any residue.

The powder of gentian is used internally as a tonic, in doses varying from a few centigrammes to one gramme.

PTISAN OF GENTIAN.

Take of Incised gentian-root, 8 grammes.
Boiling water, 1,000 grammes.

Let it infuse for two hours, and strain.

Water is a very proper menstruum to effect the solution of the active principles of the gentian. Cold water dissolves the bitter matter, the sugar, the gum, part of the pectic acid, the acid principle, the gentisin, a little fatty matter and resin, and also a portion of the volatile odorous principle. The same matters are obtained in solution by infusion in boiling water, with this trifling difference, that the proportion of dissolved resin is larger. Decoction of gentian contains always a large proportion of pectic acid, resin, and fatty matter.

EXTRACT OF GENTIAN.

The following is the best method of preparing extract of gentian:—

Reduce the root to a semi-fine powder, moisten the powder with double its own weight of lukewarm water, and let it macerate for several hours; subject the mixture now to the action of the press; add to the grounds a fresh quantity of water equal to that used in the first instance, and subject again to the action of the press. Evaporate the liquids to the consistence of a soft extract

The extraction of the extractive principle may be effected also by lixiviation. The process for this is as follows:—

Reduce the root to a semi-fine powder, moisten the latter with one half its own weight of cold water, and place the mixture in the lixiviation apparatus; taking care to pile it up loosely. This operation requires some practice. 100 parts of gentian-root yield by extraction with water as much as 50 parts of extract.

SYRUP OF GENTIAN.

Take of Gentian-root, 1 part.
Boiling water, 10 parts.
White sugar, a sufficiency.

Cut the root into thin slices, and pour the boiling water upon the latter. Let it infuse for twelve hours, and strain through a linen cloth without having recourse to pressure: the liquid obtained is perfectly clear. The grounds subjected to the action of the press yield a fresh quantity of liquid, which, however, is turbid, and requires to be clarified by filtration. Pour the two liquids together, weigh the whole, and add for every 100 parts 190 parts of sugar. Form a syrup by simple solution in the water-bath.

This syrup is very bitter, and has a strong smell.

30 grammes of this syrup contain the bitter principles of 1 gramme of the gentian-root.

TINCTURE OF GENTIAN.

Take of Gentian, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the mixture macerate for fifteen days; strain, squeeze out the grounds, and filter.

Weak alcohol extracts the whole of the bitter parts of the root.

The tincture of gentian contains the bitter principle, the sugar, the gum, the acid principle, the gentisin, and the fatty, resinous, and odorous matters.

From the results of certain experiments made by M. Personne it would appear that even 4 parts of alcohol would suffice to extract from the root the whole of the principles and matters soluble in that menstruum.

ANTISCROFULOUS ELIXIR.

Take of Gentian-root, 4 parts.
Carbonate of ammonia, 1 part.
Alcohol of 56 C. (21° Cartier), 125 parts.

Let the mixture macerate for eight days; strain, squeeze out the grounds, and filter the liquid.

PERYLHE'S ELIXIR.

Take of Gentian-root, 15 parts.
Carbonate of soda, 6 parts.
Alcohol of 56 C. (21° Cartier), 500 parts.

Let the mixture macerate for eight days; strain, squeeze out the grounds, and filter the liquid.

WINE OF GENTIAN.

Take of Gentian-root, 1 part.
Alcohol of 56 C., 2 parts.
Red wine, 14 parts.

Cut the root into thin slices, and let the latter macerate in the alcohol for twenty-four hours; add now the wine, and let the mixture macerate for eight days. Strain the liquid off.

Parmentier used the tincture of gentian for the preparation of the wine; his tincture of gentian was made with 4 parts of the root, 1 part of orange-peel, and 48 parts of alcohol of 56 C.

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c.—BITTER LEAVES.

The most frequently used of the bitter leaves are:—

The leaves of Menyanthes trifoliata,
Fumaria officinalis, and other species of that family,
Viola arvensis,
Divers plants of the family of the Chicoraceæ,
Divers plants of the family of the Cynarocephaleæ.

To these may be added the flowery tops of the Lesser Centaury.

LESSER CENTAURY.

We use the flowery tops of the lesser centaury (Chironia centaurium). These tops contain a bitter principle, which is considered an excellent tonic and febrifuge. They are usually given in infusion in doses of from 8 to 16 grammes, or in form of extract in doses varying from a few centigrammes to 1 gramme and more.

Moretti examined the lesser centaury. He found:—

A bitter extractive matter,
Free acid,
Mucous matter,
Extractive,
Several salts.

The tops should be gathered when the plant is in flower; they should be put together in small bunches, and the latter wrapped up in paper, to preserve the colour of the flowers; they ought to be dried finally in an airy loft.

The extract of the lesser centaury is prepared by displacement. Care must be taken to heap the powder rather loosely. The powder of the tops of the lesser centaury yields 25 per cent. of its own weight of extract.

MENYANTHES TRIFOLIATA.

The leaves of Menyanthes trifoliata contain a bitter juice, which enjoys considerable reputation as a tonic, anthelmintic, and antiscorbutic.

Trommsdorf has analyzed the Menyanthes trifoliata. He found:—

Green-coloured starch,
Bitter extractive,
Brown-coloured gum,
Albumen,
An animal matter which the action of fire fails to coagulate,
Inulin (?).

M. Nativelle has since succeeded to extract from the plant the bitter principle (menyanthin) in a state of purity, in form of long white needles of satinlike lustre.

M. Nativelle has observed also that the bitter extract of this plant contains no tannin, and may, accordingly, be advantageously associated with salts of iron.

JUICE OF MENYANTHES TRIFOLIATA.

The juice of the menyanthes is seldom administered pure, but usually in association with that of other plants.

EXTRACT OF MENYANTHES TRIFOLIATA.

This is prepared with the depurated juice of the plant; it yields the one sixth part of its own weight of extract. If fresh plants cannot be procured, the dried plants must be had recourse to: these are treated by lixiviation.

FUMITORY.

Under the name of fumitory we use indiscriminately the several species of the genus Fumaria, but more particularly the Fumaria officinalis. This plant enjoys considerable reputation as a remedy against diseases of the skin and certain affections of the liver. Several allied species, and even the yellow fumitory (Corydalis bulbosa), possess the same curative properties.

M. Peschier, of Geneva, has obtained from fumitory a peculiar alkaline base, extractive, resin, and a crystallizable acid. The alkaline base has not been much studied as yet; it has a bitter taste, is viscous, soluble in water, in alcohol, and in ether.

Infusion of fumitory is frequently given as a medicinal drink.

JUICE OF FUMITORY.

Pound the fumitory in a mortar, subject the mass to the action of the press, and filter the expressed juice, without the aid of heat.

PTISAN OF FUMITORY.

Take of Dried fumitory, 32 grammes.
Boiling water, 1,000 grammes.

Infuse for an hour; strain.

EXTRACT OF FUMITORY.

Take of juice of fumitory depurated and clarified by heat, any quantity.

Evaporate in the water-bath. The fresh plant yields the one fortieth part of its own weight of extract.

The dried plant, treated with water of 68° F., yields the one fifth part of its own weight of extract.

SYRUP OF FUMITORY.

Take of Depurated juice of fumitory,
White sugar, of each equal parts.

Boil to the consistence of a syrup; strain.

VIOLA ARVENSIS.

The leaves and stem of the Viola arvensis contain a bitter extractive matter.

Some physicians prefer the fresh to the dried plant.

The juice and the infusion are the preparations most frequently used.

The dose is from 20 to 100 grammes of the juice, or 12 to 16 grammes of the dried leaves for every quart of ptisan.

SYRUP OF VIOLA ARVENSIS.

Take of Dried Viola arvensis, 1 part.
Boiling water, 10 parts.
Sugar syrup, 16 parts.

Cut the plant to pieces; infuse in boiling water; strain, and subject the grounds to the action of the press. Let the liquor stand at rest

until the impurities have subsided. Decant and filter. Add the filtrate to the sugar syrup, and evaporate to syrupy consistence.

The extract of Viola arvensis may be prepared by lixiviation. For this purpose the dried plant should be reduced to powder, the latter moistened with double its own weight of water, and the mixture placed in the lixiviation apparatus, taking care to heap it up loosely, as the plant contains a large proportion of mucilaginous matters.

A better way is, to mix the powder of the plant with a sufficient quantity of water to form a soft paste, to pour this into the displacement apparatus, and to leave the liquid to drain off; the rest of the operation is then achieved by lixiviation.

This latter process was recommended first by M. Mouchon; it answers very well.

CHICORACEÆ.

The Chicoraceæ are plants with bitter juice, and which, according to some chemists, owe their lactescence to the presence of caoutchouc; at all events, Schrader and Quevenne found caoutchouc in the common lettuce, Pfaff in Lactuca virosa, and John in Leontodon taraxacum (dandelion).

The juice of the chicoraceæ is used as a tonic and stomachic. In large doses it acts as a laxative.

The species most frequently used are:—

The dandelion,
The wild endive,
Lampsana communis,
Chondrilla juncea.

Some of the chicoraceæ have sedative properties, viz., the common lettuce (Lactuca sativa), Lactuca virosa, Lactuca sylvestris, Lactuca elongata (United States), Sonchus tenerrimus (Naples). The sedative property seems to reside in the milky juice which the large vessels of the bark contain.

WILD ENDIVE OR SUCCORY.

The leaves and roots of the wild endive (Cichorium intybus) enjoy considerable reputation as possessing stomachic and depurative properties.

The wild endive is recommended in certain affections of the liver.

The leaves of the Cichorium intybus contain:—

Extractive,
Chlorophyle,
A saccharine matter,
Albumen,
Several salts; among others, nitrate of potass.

The roots of the Cichorium intybus have an analogous composition, but, according to Watt, they contain, moreover, inulin.

It is to the bitter extractive matter that the leaves and roots of the wild endive owe their medicinal properties.

The leaves of the wild endive are frequently used to make stomachic and depurative drinks. We usually prefer the fresh leaves; with these the ptisan is prepared by decoction.

With the dried leaves the ptisan is prepared by infusion, taking 12 grammes of the leaves per quart of water.

With the root the ptisan should be prepared equally by infusion, taking 20 grammes of the root (cut into small pieces) per quart of water.

SUCCORY JUICE.

Pound the succory in a mortar, squeeze out the juice, and filter.

This juice is usually given in association with the juices of other plants. It forms a constituent of what is called the juice of herbs, which some people are still in the habit of taking in spring, and which, according to the formula of the Codex, is prepared as follows:—

Take of Leaves of Cichorium intybus,
" Borrago officinalis,
" Fumaria officinalis,
" Chervil, of each equal parts.

Pound the plants, squeeze out the juice, and filter cold.

EXTRACT OF CICHORIUM INTYBUS.

Pound the succory; squeeze out the juice, and clarify by heat; strain, and evaporate to the consistence of an extract.

Another way of preparing the extract is by lixiviation of the dried leaves of the plant.

The dried leaves of the plant yield about the one fourth part of their own weight of extract.

The root yields only the one eighth part of its own weight of extract.

DANDELION.

Dandelion (Leontodon taraxacum—Taraxacum dens leonis) has the same properties as Cichorium intybus; it is used in the same way and for the same purposes as the latter.

Ingenhold has remarked that the roots of the dandelion contain a larger amount of bitter principle in summer than in spring and autumn, although, on the other hand, they contain in the latter seasons a more abundant quantity of juice than in summer.

CYNAROCEPHALEÆ.

The juice of the Cynarocephaleæ is bitter; it does not appear to possess laxative properties. It is used as a tonic and febrifuge, but it does not succeed equally well in chronic disorders of the mesenterium. The intensely bitter species are reputed to be most excellent febrifuges. To this class belong Centaurea calcitrapa, Cynara scolymus, Serratula amara (of Siberia). The less intensely bitter species are considered diaphoretic and stomachic. To this class belong: Sylibum marianum, Centaurea benedicta, Carthamus lanatus, Elephantopus scaber (of the Indies).

The nature of the bitter principle of these plants remains as yet in obscurity. However, M. Guérin Varey has extracted from the Centaurea calcitrapa, and M. Nativelle from the Centaurea benedicta, an intensely bitter matter (cnicin). These chemists obtained this principle in white and silky crystals, soluble in alcohol in all proportions, less soluble in ether, and very sparingly soluble in water. The action of boiling water upon it causes its transformation into an oily, bitter, uncrystallizable substance.

M. Nomat has successfully employed the bitter principle of the cynarocephaleæ in many cases of intermittent fever. It must be borne in mind, however, that in doses above one gramme it is exceedingly apt to cause vomiting and diarrhœa.

Centaurea benedicta is mostly given in infusion; some physicians, however, prefer the extract. This is prepared with lukewarm water. One hundred parts of the dried plant yield eighteen to twenty parts of extract.

Section II.

PURGATIVE EXTRACTIVE.

The following substances, endowed with purgative properties, owe these properties to the extractive matter which they contain. Among them are some of the most highly valuable purgatives of the materia medica:—

Cassia,
Tamarinds,
Peach flowers,
Mercury (Mercurialis annua),
Senna,
Buckthorn,
Bark of the elder-tree,
Rhubarb,
Rumex patientia,
Agaric,
Colocynths,
Elaterium,
Aloes,
Black hellebore.

CASSIA.

The fruit of the cassia (Cassia fistula) is used in medicine on account of the pulp contained in its cells, and which possesses laxative properties.

This pulp has been analyzed by Vauquelin. This chemist found it to consist of:—

Vegetable gelatine,
Extractive,
Gum,
Gluten,
Sugar,
Parenchyma,
Water.

Cassia is a very gentle purgative. It requires from 100 to 200 grammes of it to produce a decided effect.

TAMARINDS.

The tamarinds of the shops are the fleshy part of the pericarpus of the fruit of Tamarindus Indica.

Vauquelin has analyzed this fruit. He found it to contain:—

Citric acid,
Tartaric acid,
Malic acid,
Bitartrate of potass,
Sugar,
Vegetable gelatine,
Starch.

Tamarinds are frequently employed in medicine. In small doses they serve for the preparation of an acid and refreshing drink. In larger doses they purge. This is the case more particularly with the pulp of tamarinds when given in doses of 30 to 60 grammes. The purgative properties of tamarinds are universally attributed to the bitartrate of potass and the several acids which these fruits contain. They may, perhaps, contain besides these substances some peculiar purgative principles.

PULP OF TAMARINDS.

Digest tamarinds of commerce with a little water in a china vessel over hot ashes. When the fruit is sufficiently softened, pulp it, and remove the kernels and filaments.

CONSERVE OF TAMARINDS.

Take of Pulp of tamarinds, 2 parts.
Pounded sugar, 3 parts.

Mix at the heat of the water-bath, and evaporate, if required, to the consistence of thick honey.

Conserve of tamarinds forms an excellent laxative, of agreeable flavour, and which keeps very well.

PTISAN OF TAMARINDS.

Take of Tamarinds, 16 to 100 grammes.
Boiling water, 1,000 grammes.

Infuse the tamarinds in the water, taking care to stir the mixture occasionally. Strain through the bolting-cloth, with slight expression. If it is intended to render this potion laxative, a large proportion of tamarinds must be used. Whey is sometimes used as the vehicle of this potion instead of water.

PURGATIVE POTION.

Take of Tamarinds, 32 grammes.
Senna, 8 grammes.
Water, 150 grammes.
Sulphate of soda, 16 grammes.
Elæosaccharum of lemon, a sufficiency.

Dilute the tamarinds in the water, and heat to the boiling point; when the mixture has boiled up once or twice, add the senna and the sulphate of soda. Leave it to infuse for thirty minutes to one hour; strain with slight expression, and flavour with the elæosaccharum of lemon.

Salts of potass should never be associated with tamarinds, since the acids of the latter, and more particularly the tartaric acid, would decompose the salts, and thus give rise to the formation of an abundant precipitate of cream of tartar.

PEACH FLOWERS.

The leaves of the peach-tree (Persica vulgaris), and more particularly the young sprouts, are odorous, and yield upon distillation a volatile oil which bears considerable resemblance to the oil of bitter almonds. They are rarely used, although some authorities recommend them as possessing sedative properties, and some pharmacopœias

make them an ingredient of the purgative syrup of peach flowers.

The kernels or nuts of the peach are recommended by some for the preperation of sedative emulsions. They are, however, but rarely employed.

The flowers are about the only part of the tree that can be said to occupy a place in materia medica.

SYRUP OF PEACH FLOWERS.

Take of Fresh peach flowers, any quantity you like.
White sugar, a sufficiency.

Pound the flowers, squeeze out the juice, filter, and add to the filtrate twice its own weight of white sugar. Melt in the water-bath, and strain.

The syrup of peach flowers is used as a laxative and vermifuge, particularly for children.

Dose, 8 to 30 grammes.

MERCURIALIS OR MERCURY.

Mercury (Mercurialis annua) is a popular purgative. The Mercurialis perennis has much more active properties, and should, therefore, never be substituted for the annua.

Mercury has been analyzed by M. Feneulle. He found in it :—

A bitter principle,
Mucilage,
Albumen,
A colourless fatty matter,
A small quantity of volatile oil,
Pectin,
Several salts.

The bitter principle has a yellowish colour; no doubt but that in a state of purity it is perfectly colourless. It has a strongly marked bitter taste. Its purgative action is only slight. It is soluble in water and in alcohol. It is precipitated by subacetate of lead, bichloride of mercury, and infusion of gallnuts.

HONEY OF MERCURIALIS.

Take of Non-depurated juice of mercurialis,
Honey, of each equal parts.

Boil to the consistence of a syrup. The heat coagulates the albumen of the juice, and effects thus the clarification of the syrup.

LAXATIVE CLYSTER.

Take of Emollient decoction, 400 grammes.
Honey of mercurialis, 60 grammes.

Mix.

PALE OR WHITE ROSES.

The pale or white rose is the flower of Rosa semperflorens and Rosa centifolia.

The juice of the white rose is used as a laxative.

ROSE JUICE.

Pound the petals in a mortar, squeeze out the juice, and filter.

SYRUP OF WHITE ROSES.

Take of the Depurated juice of white roses,
Sugar, of each equal parts.

Mix; and boil the mixture to the consistence of a syrup.

This syrup is used as a gentle laxative for children.

Dose, 30 to 60 grammes.

SENNA.

The senna usually employed in medicine consists of a mixture of the leaves of Cassia acutifolia, Cassia obovata, and Cynanchum oleæfolium.

According to an old analysis of Lassaigne and Feneulle, the leaves of senna contain :—

Cathartin,
Chlorophyle,
A small quantity of volatile oil,
Yellow colouring matter,
Mucous matter,
Albumen,
Malic acid,
Several salts.

According to these chemists, the cathartin is the purgative principle of the senna.

Cathartin is an uncrystallizable matter, resembling in appearance gum arabic. Its taste is bitter and nauseous. It is soluble in water and in alcohol, but insoluble in ether. Given internally, it excites vomiting and purging. It has not yet been sufficiently studied.

MM. Chevalier and Lassaigne have obtained a species of cathartin (apparently identical with that of the senna) from the Cytisus laburnum. To this principle they have assigned the name cytisin.

There appears certainly to be a gap in this analysis, for cathartin is exceeding soluble in water; and yet all the ancient writers on the subject agree that the medicinal action of senna is strengthened by decoction, or by the use of alcohol as the vehicle of administration, or by the influence of acid liquors.

POWDER OF SENNA.

Reduce the senna to powder, leaving only a trifling residue.

INFUSION OF SENNA.

The infusion of senna purges at the dose of sixteen grammes. It has a nauseous smell, which often excites vomiting from the disgust which it provokes. This smell appears to be owing to the volatile oil. It may be disguised in a manner by the addition of some aromatic substance, aniseed, fennel, lemon, &c.

Some physicians prefer to the infusion the liquid obtained by simple maceration in cold water.

SENNA COFFEE.

Take of Ground coffee (roasted),
Senna leaves, of each 16 grammes.

Infuse the coffee in the usual way. Make an infusion or slight decoction of the senna. Mix the two liquids; add milk to the mixture, and sweeten at pleasure.

This purgative, which children take without repugnance, is recommended by M. Bandelocque in scrofulous affections.

PURGATIVE POTION.

Take of Senna leaves, 8 grammes.
Sulphate of soda, 16 grammes.
Rhubarb, 4 grammes.
Manna, 64 grammes.
Boiling water, 120 grammes.

Infuse the senna leaves and the rhubarb in the boiling water; let the infusion stand on hot ashes for fifteen or thirty minutes; add the sulphate of soda and the manna; when the whole is dissolved strain the solution with slight pressure. Decant the strained liquid, and flavour with a little mint-water or cinnamon-water.

PURGATIVE CLYSTER.

Take of Senna leaves,
Sulphate of soda, of each 16 grms.
Boiling water, 500 grammes.

Infuse the senna in the water for one or two hours; strain, and add the sulphate of soda.

EXTRACT OF SENNA.

Take of Senna, any quantity you like.
Boiling water, a sufficiency.

Infuse the senna in the water, strain the infusion, and evaporate the liquid to the consistence of an extract.

The mixed leaves of Cassia acutifolia, Cassia obovata, and Cynanchum oleæfolium, yield the one half of their own weight of dry extract, *i.e.*, with boiling water; with cold water they yield only three eighths of their weight. With alcohol they yield one third of their own weight of dry extract.

COMPOUND APPLE SYRUP.

Take of Senna, 8 parts.
Fennel seeds, 1 part.
Cloves, $\frac{1}{8}$th part.
Depurated juice of pippins, 60 parts.
" " borage,
" " bugloss, of each 50 parts.
Sugar, 60 parts.

Make a syrup secundum artem, and pour it boiling over
Cloves,
Fennel, of each $1\frac{1}{2}$ part,
tied up in a linen rag.

Infuse for six hours. Strain.

ALCOHOLIC TINCTURE OF SENNA.

Take of Senna, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the senna macerate in the alcohol for fifteen days; strain with expression. Filter.

One part of this tincture represents somewhat less than one fifth of its own weight of senna leaves.

FOLLICLES OF SENNA.

The follicles of senna are the fruits of Cassia acutifolia.

According to Feneulle's analysis their composition is analogous to that of the senna leaves, with this difference, however, that the follicles contain less cathartin and a great deal more mucilage than the leaves.

This result is in perfect accordance with medical experience: the follicles are less purgative than the leaves. According to Mathiolle, however, this difference would appear to be owing entirely to the late gathering of the follicles. Mathiolle states that follicles gathered in full succulence, and before the seeds have come to maturity, act as energetically as the leaves.

The follicles are used in infusion, like the leaves; they are, however, more rarely employed than the latter.

BUCKTHORN.

The juice of the fruits of the buckthorn (Rhamnus catharticus) has been analyzed by Vogel.

It contains :—

Rhamnin,
Acetic acid,
Mucilage,
Sugar,
Nitrogenous matter.

The mucilage is of peculiar nature. Vogel and Hubert have observed that it disappears almost entirely by fermentation. It abounds in the fresh juice, and imparts consistence to it.

M. Fleury, of Pontoise, has extracted from buckthorn a highly interesting matter, called by him rhamnin. This matter is usually obtained in light flakes, rarely in crystalline needles; it has a pale yellow colour and very feeble taste; it is almost insoluble in water, in cold alcohol, and in ether, but dissolves very largely in boiling alcohol. Alkaline solutions dissolve it readily; the solution appears of a magnificent saffron colour; upon saturation with acids this colour vanishes again, and the rhamnin precipitates. Rhamnin dissolves in sulphuric acid and in hydrochloric acid, but precipitates again from these solutions upon dilution with water. Nitric acid transforms rhamnin, among other products, into a yellow crystalline matter.

M. Fleury takes the still slightly-green berries of the buckthorn, reduces them to pulp, and boils the latter with water; from this decoction the rhamnin is deposited upon cooling; it is then washed repeatedly with cold water and weak alcohol, and finally dissolved in strong boiling alcohol, from which solution it is deposited again upon cooling.

In a state of perfect purity rhamnin is white; the oxidizing action of the air, however, makes it turn first yellow, afterwards red, and finally brown.

In the fruits of the buckthorn the colouring matter is influenced by the alkalis, which make it turn green, and by the acids, which cause it to assume a red tint. No doubt this is a complex action resulting from a reaction both upon the rhamnin and upon the yellow, red, and brown matters produced by its alteration.

The colouring matter of the several species of the Buckthorn family is utilized in the arts. It is generally prepared from the fruits of the Rhamnus infectorius, but sometimes also from those of the Rhamnus catharticus, Rhamnus frangula, and Rhamnus alaternus.

The purgative principle of buckthorn remains, as yet, perfectly unknown.

The fruits of the buckthorn intended for me-

dicinal purposes should be gathered only when they have arrived at perfect maturity.

BUCKTHORN JUICE.

Crush the fruits of the buckthorn between your fingers. Let the crushed mass (fluid and all) ferment for three or four days. Strain, and squeeze out the grounds. Allow the impurities to subside. Filter, and keep the filtrate in well-corked bottles.

INSPISSATED JUICE (ROB) OF BUCKTHORN.

Evaporate the depurated buckthorn juice to the consistence of an extract. The inspissated juice is hardly ever used for other purposes than the preparation of the syrup at the season of the year when it is impossible to procure the fresh juice.

SYRUP OF BUCKTHORN.

Take of Depurated buckthorn juice,
White sugar, of each equal parts.

Boil to the consistence of a syrup.

MM. Henry and Guibourt substitute clarified syrup for the sugar, in the proportion of 3 parts of syrup to 2 parts of the juice. This process is more economical than the preceding one, and it answers equally well.

Syrup is about the only preparation of buckthorn which is used in medicine. In doses of 32 to 64 grammes it acts as a purgative.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ESTIMATION OF BROMINE IN SALT SPRINGS.

By H. YEHLING.

Bromine in brine can only be detected by concentrating and forming mother liquors. Any quantitative determination of the bromine in brine would be very inexact, the quantity present being always very small indeed. The estimation, according to the usual method of heating the chloride and bromide of silver, and ascertaining the loss, is not very accurate even in the leys. Some of the chloride of silver contains only traces of bromide; the loss is small according as there is less bromide of silver in the mixture; and thus the result is rendered dubious by the inevitable error of observation. Thus, if 5 grammes of the silver precipitate decrease only 1 milligramme when heated in chlorine, the result is already rendered uncertain, and can only be considered as an approximation to the fact, for $\frac{1}{4}$th of a milligramme, more or less, involves a difference of 50 per cent. But sometimes the difference in weight of the chloride of silver before and after treatment with chlorine is still less, and then the result is totally useless.

In the leys I examined bromide could be detected, but in so small quantities that the ordinary methods of estimating it could not be appealed to. The brines, too, contained bromine, but the determination of this was even more uncertain, for the precipitate obtained from the mother liquors even exhibited at the most a difference of 0.005 to 0.001 grm. No useful result could be arrived at in this way. I then tried Heine's plan of setting the bromine free by chlorine, dissolving it in ether, and inferring the amount of bromine by the depth of the colour. It is necessary for the purpose to procure a standard liquor containing a known amount of bromine. I found by experience that the mother liquors contained a maximum of 0.020 grm. of bromine in 60 grms. I accordingly prepared ten different liquors, consisting of 60 grms. each, of saturated solution of pure chloride of sodium,* which contained from 0.002 to 0.020 grm. of bromine† (each increasing 0.002) in the form of bromide of potassium, the bromine of which preceding experiments had determined to be 62.3 per cent.

Ether was then mixed with the test liquids, in equal volumes, and afterwards a definite quantity of chlorine-water, carefully adapted by the amount of the bromine, as too much or too little chlorine makes the colour appear fainter than when the proper quantity is employed. It is always important to ascertain exactly the point of deepest colouring; for that purpose the author took from two to three glasses of the test liquor of the same strength, and mixed them by degrees with the different quantities of chlorine until the darkest hue was attained. This colour served for a standard of comparison, and a scale of colours was constructed on it becoming progressively brighter. Sixty grammes of each mother liquor were next taken and poured into glasses, each mother liquor furnishing the contents of two or three glasses, which was then mixed with the same amount of ether as the test liquor, and with the needful amount of chlorine. The quantity of bromine present is found to be within 1 or 2 milligrammes, *i.e.*, to $\frac{1}{60000}$ or $\frac{1}{30000}$, by comparing the colour of the ether of the mother liquor with that of the test liquor. In order to obtain the necessary certainty as to the correctness of these results the experiments should be repeated several times. Of course the experiments must be brought to a conclusion as quickly as possible after the addition of chlorine to the bromine liquids, and the direct rays of the sun should be avoided. My experiments were carried on with a clouded sky. When the glasses are all filled with the solution of salt, or with other liquors, and ether has been mixed with them, the experiment may soon be despatched with the aid of an assistant; and, as many experiments have to be made, it is important to effect the greatest possible saving of time. Whenever all the necessary precautions were observed, and the operation got over quickly, also taking care to avoid a strong light, a uniformity attended the results which spoke highly for the accuracy of the process. In my earlier experiments I was led to underestimate the quantity of bromine actually present, especially where its proportion was large; this arose from my having employed an insufficient amount of chlorine-water. To check the results of this method I resorted to the fractionated precipitation of the chlorine pointed out in Rose's "Manual of Analytical Chemistry," where he states that the whole of the bromine is precipitated, and contained in its last portion. For that purpose I took 100 grammes of mother liquor, and added each time $\frac{1}{10}$ of the silver solution necessary to precipitate the entire quantity. When $\frac{8}{10}$ had been precipitated it was collected on a filter, washed, and the filtered solution completely precipitated. Both precipitates were fused and treated with chlorine, and the last precipitate was found after two hours' treatment to have lost nothing of its chlorine in weight. On the contrary, the first precipitate decreased as much as, if not more than, the chloride of silver obtained from another quantity of liquor precipitated at once. I next endeavoured to ascertain if the first portions of silver precipitated from a concentrated solution of chloride of sodium contain any bromine, and in each of several experiments I found that it did; in this manner, therefore, 0.00001 of bromine may be detected. On the electro-chemical hypothesis, nearly all the chloride of silver ought to be thrown down before bromide is formed, which was not the case in my experience, perhaps on account of the greater insolubility of bromide of silver in a strong solution of chloride of sodium. The following experiments prove that in this manner bromide of silver may be, so to speak, concentrated, and bromine separated from large quantities of chloride of sodium:—300 grammes of chloride of sodium, in solution, were mixed with 0.460 bromide of potassium = 0.2865 bromine, forming, therefore, about 0.001. The whole of this mixture was now added, in the cold, to one sixth the quantity of solution of silver, which would have been requisite to precipitate the whole, then shaken, filtered, and washed. The filtered solution was again concentrated and precipitated with a solution of silver, and the operation performed a third time. I thus obtained three precipitates, which I will call *a*, *b*, and *c*; the gross amount of these was about one fourth what the solution of salt would have yielded, had the whole been precipitated. After fusion these precipitates weighed—*a*, 27.525; *b*, 10.336; and *c*, 6.374 grammes. A quantity of the precipitate was placed, after fusion, in a reduction-tube, from which moisture was expelled by driving through it a current of dry hot air; the fused precipitate after weighing was repeatedly treated with dry chlorine until the weight remained unaffected after half an hour's action of the chlorine. (When dealing with large quantities of bromine it was often found necessary to treat the precipitate with chlorine several successive times, each time from twenty minutes to half an hour, in order to effect its thorough decomposition, whereas when only a few milligrammes of bromine were present one treatment of from fifteen to twenty minutes sufficed.)

The precipitates above mentioned gave the following results:—

5.490 grammes silver precipitate of *a* lost in the whole	.....	0.033 grm.
5.474 grammes silver precipitate of *a* lost in the whole	.....	0.029 "
4.236 grammes silver precipitate of *a* lost in the whole	.....	0.025 "
15.200 grammes of silver precipitate therefore lost	.....	0.087 grm.

which for the whole silver precipitate *a*, 27.525, amounts to 0.1575 loss = 1.7957 + 0.1575 = 0.2828 gramme of bromine. 4.714 grammes of precipitate *b* did not lose in weight after treatment with chlorine for two hours; the same is to be said of *c*. In this case any diminution of weight only affects the sixth part of the precipitate, and, as it is six times as great as if it had been spread over the entire quantity, the possibility of mistake is diminished in that proportion. Besides the foregoing I made the subjoined experiments with solutions of various strength:—In 1.100 solution of chloride of sodium, mixed with 0.036 bromide of potassium (=0.0225 grm. bromine), is contained $\frac{1}{50000}$ bromine. I precipitated 24.654 grammes of chloride of silver in the cold, and subsequently 16.398:—

5.555 grammes of *a* lost	....	0.004
5.507 "	"	0.002
5.658 "	"	0.003
16.720 grammes lost	.....	0.009 = 0.016 grm. bromine.

Thus, in 24.654 grammes chloride of silver, 0.0236 gramme bromine is contained.

In another experiment 1,000 grammes of chloride of sodium in the same state of dilution were taken, mixed with 0.02243 gramme bromine, and 15.545 grammes of chloride of silver *a* and 21.035 grammes *b* were precipitated:—

4.899 grammes of *a* lost	.....	0.0035
4.754 "	"	0.00425
9.653 lost	.....	0.00775 grm.

or 15.545 grammes lose 0.0125 gramme = 0.0224 bromine. Chlorine did not disturb the weight of precipitate *b*.

By this method useful results are obtained, even when the proportion of bromine present does not exceed $\frac{1}{100000}$. 2,000 grammes of the solution of chloride of sodium were mixed with 0.0206 gramme bromine, and 21.466 grammes *a* and 16.938 *b* were precipitated from it:—

5.383 grammes of *a* lost	....	0.003
6.150 "	"	0.0033
11.533 lost, therefore	.....	0.0063 grm.

This, for 21.466 grammes chloride of silver, gives 0.0117 = 0.021 gramme bromine. Treatment with chlorine did not diminish the weight of *b*.

* Heine recommends water, but I preferred the saturated solution of chloride of sodium, because the water diminishes the volume of the ether, and thus changes the intensity of the colour.

† In order to avoid any error which might arise from dealing with such minute quantities of bromide of potassium, 1 grm. of bromide of potassium (equal to 0.623 bromine) was weighed off, formed into a given volume of solution, and the desired quantity of this solution added to the solution of chloride of sodium by measure.

It is evident from the foregoing facts that it is possible by my method to determine the amount of bromine with great accuracy, even in liquids not containing more than 0.001 to 0.00001 of that element, and that a tolerably correct result may be arrived at where its quantity is yet smaller; the estimation of such minute quantities is, however, seldom of any importance. Where more than $\frac{1}{1000}$ bromine is present the method is suffieiently dclicate. It should be here observed that the precipitate from the eoncentrated solution of chloride of sodium, of whieh only a part has been thrown down, requires very protracted washing; it was frequently neeessary to continue that operation for two or three days.

It should be preeipitated in the eold, and, as the amount of bromine rises, the proportion of chlorine precipitated should be greater. Where the amount of chlorine was about $\frac{1}{1000}$ I employed from $\frac{1}{5}$ to $\frac{1}{6}$ of the silver solution necessary to discharge the whole; with 0.0001 bromine about $\frac{1}{10}$ of the requisite quantity of the silver solution; with 0.00002 about one $\frac{1}{30}$; and with 0.00001 $\frac{1}{60}$ of the solution. I do not know that a smaller amount of silver solution would not have been sufficient, and that the bromine might not be obtained more concentrated; but experience has convineed me that it is necessary not to precipitate too little chloride of silver, and to use the solution cold. The foregoing method has enabled me to determine the amount of bromine present in mother liquors from the saltworks, and the results obtained have corresponded with the estimation of the bromine from the colour of the ethereal solution.—*Journ. für Prakt. Chem.*, vol. xlv., p. 269.

ON THE ACTION OF ALKALIS AND ACIDS UPON ALDEHYDES, AND THE PRODUCTS RESULTING THEREFROM.

By H. HEIDENBUSCH.

Liebig has obscrved that in the action of potash upon aldehyde a very irritating odour is given off; the author traees this to a volatile oily substance whieh is rapidly affeeted by the air, and ultimately becomes changed into a resin differing in very many partieulars from the true resin of aldehyde. This volatile oil when isolated is thick, of a golden hue, and has an agreeable odour, suggesting that of einnamon; it is completely dissolved in ether and alcohol, and partially soluble in water. It is oxidated by nitric acid much more rapidly than in the air. The eonnection of the oil and resin is so close that the latter may be boiled for several days without losing its odour. Thc resin as obtained by the author was a bright orange substanee, whieh lost its depth of hue by eontinued exposure to a temperature of 212°. It is solublc in ether, alcohol, and partially so in water. It is scarcely dissolved by aeids; eoncentrated sulphuric aeid dissolves it, but not completely, and from that it is again precipitated by water. When in alcoholie solution its eolour may be entirely removed by passing a few bubbles of ehlorine through it, and, if water be then used, a snow-white preeipitate will be thrown down, which, however, will eontain chlorine. After a careful purification, the resin furnished in analysis 76.40 per cent. earbon, 7.97 hydrogen, 21.63 oxygen. The smallness of the amount of oxygen revealed by this analysis indicates that, when aldehyde is decomposed, substances must be eliminated containing more oxygen. Aecordingly, on examining the alkaline liquid, acetic and formie acids were found, and some of the reactions gave reason to suspeet the existence of acetylous aeid.

Action of Acids on Aldehyde.—Nitric aeid converts aldehyde into aeetic acid, and sulphurie aeid blackens it: beyond this the author has little to communicate under this head. When two parts by volume of pure aldehyde are mixed with one of water, and a traee of sulphuric or nitric acid is added, the vessel being reduced to a temperature of 32°, crystals soon separate, aeieular in form, and the odour of the supernatant liquid has disappeared, and the liquid refuses to mingle with water. The reactions of these erystals pointed to the infusible metaldehyde deseribed by Liebig. The supernatant liquid was decanted and shaken with water to remove any aldehyde whieh might linger behind in an undecomposed state, and the liquid thus dried, and yet floating on the water, was dried by the agency of ehloride of caleium. The produet is a

New Modification of Aldehyde; its composition, $C_4 H_4 O_2$, as well as the density of its vapour, agreeing with that diseovered by Fehling, but its properties differing. It is a thin, pure, transparent liquid, having a peeuliar aromatie odour and burning aerid taste; it is soluble in aleohol and ether, and sparingly in water. Its boiling point is 257°, and in the retort it distils over unchanged. Alone, and also with water, it changes speedily into an acid, the water in the latter ease slowly decreasing, and erystals frequently separating. Potash does not affect it. It is somewhat singular that this liquid is converted back again into aldehyde on heating with a trace of sulphurie acid, and that the same aeid which converts aldehyde into this new substance at low temperatures effects its reconversion into aldehyde at a higher temperature. Nitrie aeid acts in just the same manner. The action of the two acids ean, therefore, be regarded in no other light than a dynamic one, because the aeids exist unehanged in the liquids, where they may be detected by the proper tests. The precise charaeter of the aeid into which this new modification is changed is not at present known to the author. The acid is not formed by alkalis or oxidizing agents, but only by exposure to the air: alkalis appear to exert no proper action on the liquid. When a little of the liquid which had beeome acid in the air was saturated, a crystallized salt of baryta was obtained, whieh was readily soluble in water, redueed salts of silver, and gave a white precipitate with proto and per salts of mereury. The former salt was reduced when the metal was heated: the precipitate remained white even on boiling. The last portions which eame over and were free from unehanged aldehyde were taken for analysis, and gave the following results:—

					Vols.	Calculated density of vapour.
Carbon.....	54.15	54.35	4 = 24	54.55	3	2.52837
Hydrogen..	9.13	9.11	4 = 4	9.09	6	0.41280
Oxygen....	36.72	36.54	2 = 16	36.36	1½	1.65390
	100.00	100.00	44	100.00		

Experiment determined the density of the vapour 4.5830.

Aldehyde under the Action of Sulphuretted Hydrogen.—When this gas is passed through a mixture of aldehyde and water the liquid is rendered turbid, and, if the process is eontinued as far as saturation, a thick, transparent oil settles at the bottom of the vessel. As the oil will not deposit from a liquid whieh has not been thoroughly saturated, the gas must be direeted through the liquid for a considerale time. It is separated from the water by deeantation; the last traces of the latter must be removed in vacuo, as ehloride of calcium and other dehydrating substances decompose it even at a low temperature. It yields sulphuret of caleium with ehloride of caleium, and aldehyde is simultaneously evolved. Thc eomposition of this oil is $C_{12} H_{13} S_7 = 3$ atoms of an aldehyde in whieh sulphur and 1 atom of sulphuretted hydrogen take the place of the oxygen. It is a thiek, transparent liquid, has a very strong odour like that of garlie, and sticks most tenaciously to the hands and elothes. It is sparingly soluble in water, readily dissolves in ether and alcohol, and mixes with fatty and volatile oils. It evaporates quiekly, and fills every place with its abominable stench, although it does not begin to boil at a lower temperature than 356°. Heated in a closed vessel, it boils at 356°; the boiling point, however, eontinues gradually to rise, and the eolour of the oil becomes brown, till at last a smeary mass is left in the retort, whieh, as it eools, solidifies into a cake of crystals of the aeetylic mercaptan described in the next section. The sp. gr. of the oil is 1.134. On analysis the following numbers were given:—

Carbon.....	36.37	36.14	12 = 72	36.54
Hydrogen....	6.67	6.70	13 = 13	6.59
Sulphur	56.43	56.74	7 = 112	56.35

This oil is decomposed by ammoniacal gas, and thialdine is produeed, 3 equivalents of sulphuretted hydrogen being given off, and 1 equivalent of ammonia absorbed. There can be no doubt that the product whieh ammonia forms with the base $C_{12} H_{10} S_4$ has a transient existence in this reaction. The odour of thc oil changes when ammonia is passed through it, and, instead of the nauseous smell, that of ammonio-aldehyde is produced; the liquid beeomes milky, and, after a few days, thialdine separates in beautiful rhombic crystals. Thc author analyzed the muriate obtained by passing muriatic gas through thc oil saturated with ammonia after solution in ether, in which muriate of thialdine is insoluble; he found,

Carbon	35.73	12=72.0	36.10
Hydrogen.....	6.90	14=14.0	7.02
Nitrogen	7.16	1=14.0	7.02
Sulphur	31.79	4=64.0	32.09
Chlorine.....	17.53	1=35.4	17.77

Acetylic Mercaptan.—This body, from its composition, $C_4 H_4 S_2$ (but not in its deportment with peroxide of mereury), stands in the same relation to aldehyde as mercaptan does to aleohol. It is formed from the thiek oil above deseribed in several ways, as by exposing the oil to the air, by heating, and also by the ageney of acids. When the oil is placed in a watehglass over sulphuric acid in a bellglass, the aeid turns brown, and erystals of acetylie mereaptan adhere to the sides of the glass in great abundance. The oil eannot, therefore, be deprived of water in this manner. Chlorine in small quantity passed into the oil affeets it in the same way as hydroehlorie aeid, *i.e.*, it separates $C_4 H_4 S_2$, but this substance again disappears if the quantity of chlorine is increased, and an oily liquid with an insufferable odour is generated, in whieh ehlorine and sulphur are doubtless contained. Moreover, if a drop of strong sulphurie aeid be added to thc oil, it instantly changes its form, and beeomes a solid, white, erystalline mass, and sulphuretted hydrogen is evolved. An addition of sulphurie acid dissolves these crystals, the solution having a transient brown colour, but water again preeipitates them. Hydrochloric acid aets like sulphuric acid, and when passed through the oil in a gaseous state it causes it to congeal to a solid eake of erystals. In this body no oxygen has been found, but its place is oeeupied by sulphur; it is formed from the oil, by the separation of one atom of sulphuretted hydrogen from the substanee $C_{12} H_{13} S_7$—$HS = 3C_4 H_4 S_2$.

Acetylic mercaptan crystallizes in very brilliant white needles, having a disagreeable odour like garlie; sublimation eommences at 113°, when the crystals separate in loose, flaky, snow-like masses. This eompound is dissolved by alcohol and ether, but sparingly by water, with whieh it distils over, floating on its surface. It separates from its solution in alcohol in beautiful shrublike crystals, whieh adhere to the sides of the vessel. Neither ammonia nor potash has any action on aeetylie mercaptan. Nitrie acid causes it to effervesce violently when poured over it. When treated with salts of silver the whole of the sulphuret is not obtained as sulphuret of silver, but the erystalline mass eombines with nitrate of silver to a salt of determinate composition. It was preferred, therefore, to

determine the sulphur by mixing the substance with nitrate and carbonate of soda, and heating in a combustion-tube. On analysis the numbers were :—

Carbon....	39.44	39.65	4=24	40.00
Hydrogen..	7.10	6.87	4= 4	6.67
Sulphur .. .	53.05	53.40	2=32	53.33

A Compound of Acetylic Mercaptan with Nitrate of Silver, $C_6 H_6 S_3 + AgO, NO_5$, or $3 (C_4 H_4 S_2) + 2AgO, NO_5$, is produced by mixing an alcoholic solution of acetylic mercaptan with nitrate of silver in alcoholic solution. A thick white precipitate is deposited, which soon changes colour. It shrinks considerably on the application of heat, sulphuret of silver separates in black flakes, and the silver compound in solution is contained in the hot alcohol. It should be filtered while boiling, when it immediately separates, partially upon the filter itself, in laminæ, having a pearly lustre ; those after some time settle at the bottom of the vessel as a soft precipitate. On this account it is preferable to dilute the alcohol with some water, which renders the salt more easily soluble, and thus the too early separation of the crystals is obviated. The salt consists of a delicate white powder in minute crystalline scales. Exposure to the light tarnishes it, and it has the smell of mercaptan. On the application of heat it yields nitrous acid, and becomes black, perhaps by the formation of sulphuret of silver. When decomposed with alkalis in a retort, acetylic mercaptan distils over. It dissolves completely only in absolute alcohol. In cold alcohol its readiness of solubility increases in proportion to its degree of dilution.

In form and external aspect this salt bears great resemblance to that which is produced when nitrate of silver is added to a solution of ammonio-aldehyde. It is decomposed, as that is, when its solution is evaporated, and deposits black sulphuret of silver.

This compound, however, is unique. There is no other example of an oxyacid—for so the nitrate of silver must be regarded—entering into combination with a sulpho base like mercaptan.

From the reactions of this compound, the second of the two formulæ given above would seem to express with greater exactness the composition of the body, its atomic weight at the same time confirming the calculated composition of mercaptan $= C_4 H_4 S_2$. The salt gave on analysis :—

Carbon.....	13.49	13.52	12=72	13.84
Hydrogen	2.45	2.77	12=12	2.31
Sulphur.....	18.26	18.53	6=96	18.46
Oxide of silver	44.77	44.59	2=232	44.63
Nitric acid....	20.88	20.86	2=108	20.76

—*Ann. der Chem. und Pharm.*, xxvi., p. 152.

NITRATE OF MAGNESIA IN WATER—FORMATION OF AMMONIA BY NASCENT HYDROGEN BY THE AGENCY OF IRON IN ITS METALLIC STATE.

By H. OSBORN, Esq., of Southampton.

For some time past my attention has been directed to an extraordinary corrosion of iron pipes laid down in place of lead for transmitting water. I observed in some localities where iron was used the corrosion lasted for the space of about twelve months, during which time an insoluble rust formed in the interior of the pipes, and afterwards the water was comparatively free from iron; while in other places not far distant the formation of rust was constant, which rendered the water unfit for domestic use. Several applications were made to me upon the subject: at length I analyzed the water where the corrosion took place, and found the presence of nitrate of magnesia, but after the water had been resting in contact with iron ammonia was formed, and oxide of iron precipitated. From this observation I was led to conclude that the water and the nitrate of magnesia suffered decomposition ; the nascent hydrogen united with the nitrogen of the nitrate to form ammonia, and the oxygen with the iron to form oxide of iron. I have tried the experiment on water containing naturally nitrate of magnesia, and on an artificial compound, by introducing cast-iron nails into bottles of the water, when a copious precipitate was obtained of protoxide and peroxide of iron, but chiefly the latter. On examining the water after filtration ammonia was found in solution, which yielded muriate of ammonia when evaporated with a few drops of hydrochloric acid ; and on treating the ammoniacal salt with a solution of bichloride of platinum, the yellow powder of the ammonio-chloride of that metal was obtained.

The result of this investigation has proved that iron* should never be used for transmitting water when nitrate of magnesia is contained in it, because the corrosive action can never be arrested.

I am at a loss to know whether the conversion of the nitrogen into ammonia by means of the above cheap and simple process may be turned to advantage by agriculturists; the subject, however, is open for application connected with that art.

ON A NEW MODIFICATION OF PHOSPHORUS.

By M. A. SCHROETTER.

It is well known that phosphorus, when exposed to the action of light, assumes a red colour; and it is generally supposed that this change of colour takes place equally *in vacuo* and in all gases, and that it is never attended with the slightest chemical modification of the phosphorus. According to Vogel, however, phosphorus, when exposed to the action of light in nitrogen gas, turns white, instead of red.

The opinions of chemists differ considerably respecting the causes to which these curious facts are to be ascribed. Thus, Berzelius attributes the red coloration of phosphorus under the influence of light to a simple modification of that substance, unattended with any chemical change or combination. This opinion is strongly supported by the important facts discovered by Berzelius regarding the mode of action of phosphorus upon sulphur, and the formation of the metallic sulphophosphurets. Other chemists look upon the red-coloured phosphorus as a mixture of phosphorus with oxide of phosphorus.

This is the opinion of L. Gmelin, for instance. This chemist considers it probable that the phosphorus which turns red under the influence of light, *in vacuo* or in an inert gas, has not been sufficiently dried, and that fixation of oxygen may accordingly take place in consequence of ensuing decomposition of the water which still adheres to the phosphorus.

Such was the state of our knowledge upon this question when (in the month of June, 1845) I was instructed to examine it most carefully in all its details and bearings.

I deemed it, in the first place, necessary to ascertain whether the presence of oxygen, free or in combination, was indispensable for the manifestation of the phenomenon.

For this purpose I introduced perfectly pure and white phosphorus, which had previously been most carefully dried, into a bulbed tube, which I then placed in communication with a carbonic acid apparatus ; the air had previously been expelled from this apparatus, and the gas most thoroughly dried by transmission through appropriate tubes. The tube containing the phosphorus was made to communicate at one end with a chloride of calcium tube ; at the other with a tube dipping in water.

The gas was then sent in a continuous stream upon the phosphorus, until the bubbles which escaped from the apparatus were of a nature to be completely absorbed by potass. The tube was now heated gradually to a temperature above 212° Fahr., in order to remove every trace of moisture. After this I closed both the ends of the tube by fusion in the flame of the spirit-lamp, commencing with the end communicating with the gas apparatus. I now exposed the phosphorus, thus perfectly dried and removed from all possible contact with oxygen, to the action of light. The phosphorus turned speedily red ; the promptness and rapidity with which this modification ensued varied in a direct ratio with the vividness and intensity of the light. But even the action of diffuse light falling upon the phosphorus only after transmission through a layer of water, and at a temperature of 57.2, suffices to colour phosphorus intensely red in the course of a few days.

It is easy to see that the red coloration of the phosphorus is confined to the surface ; the phosphorus is found unaltered beneath the minute red particles which subsequently detach themselves.

The experiment gives the same results with pure hydrogen or pure nitrogen gas.

The results of these experiments prove evidently that the red coloration of the phosphorus under the influence of the light cannot be attributed to oxidation. I shall hereafter in the course of this essay demonstrate that the red body which separates is simply pure phosphorus, but in a peculiar and amorphous state.

I endeavoured now to ascertain whether other agents besides light possessed the faculty to effect this modification of phosphorus. I naturally turned my attention first to heat.

Having constructed an appropriate apparatus, I commenced the experiment by expelling all traces of moisture from the phosphorus, and removing every trace of oxygen from the apparatus.

The temperature in this preliminary operation was raised to 212° F. I now raised the temperature gradually to 302° F., at which degree the phosphorus sublimated, without having previously exhibited any appearance of change in colour or otherwise. The sublimated phosphorus recondensed in limpid drops like water, which fell back into the body of the retort in which the experiment was conducted.

When the temperature had reached about 438° to 440° F., and been kept stationary at that point for some time, the phosphorus was observed to assume a carmine-red colour, exactly similar to that which it acquires under the influence of the light. The colour turned gradually deeper, and the phosphorus became at last perfectly opaque. This transformation of the phosphorus did not take place suddenly, but gradually and successively. I was thus enabled to observe distinctly that a red powder or dust separated from the phosphorus and subsided to the bottom of the vessel. Having kept the phosphorus exposed for forty-eight hours uninterruptedly to a temperature of between 464° and 482° Fahrenheit, I found deposited at the bottom of the vessel a solid layer of amorphous phosphorus ; the upper layer still consisted of a certain quantity of common phosphorus, mixed, however, also with a tolerably large proportion of the amorphous variety.

If, after refrigeration, water heated to from 122° to 140° Fahrenheit is introduced into the retort, the upper layer alone of the phosphorus enters into fusion, and moulded sticks, coloured uniformly coral red throughout the whole of their mass, may be extracted from it in the usual way. These sticks are harder and more tenacious than those of the common phosphorus. Upon breaking them, which requires a greater effort than is usually the case with common phosphorus sticks, an appearance of luminousness is observed, and the phosphorus takes fire, even though its initial temperature should be as low as 32° Fahr.

The temperature at which phosphorus passes to the amorphous state is not susceptible of a very precise determination. I have seen the transformation take place at 419° Fahrenheit, but only after long-protracted application. Between 464° and 482° Fahrenheit the effect is much more rapid. The simultaneous action of heat and light accelerates the transformation

* Iron pipes should always be cemented with some kind of cement.

considerably.—*Annales de Chimie et de Physique, Décembre*, 1848.

[*To be continued.*]

ESSENTIAL CONSTITUENTS OF BEER.

The following table shows the results of F. L. Blei's analyses of several sorts of beer:—

	Extract of Malt.	Absolute Alcohol.	Carbonic Acid.	Acetic Acid.
Bernburg brown beer	8.500	2.660	0.130	0.00077
Bernburg brown beer	8.750	3.660	0.150	0.00680
Bernburg brown beer	6.000	0.950	0.150	0.01400
Old Bernburg brown beer	7.200	6.555	0.155	0.00105
Gose beer	4.305	5.000	0.108	0.00500
Peissen Broihan*	4.410	5.000	0.076	0.00550
Genuine old Bavarian beer	6.430	8.330	0.140	1.00108
Genuine old Bavarian beer from Ballenstädt	5.460	9.500	0.119	0.00520
Best old Ballenstädt beer	9.630	6.330	0.130	0.00780

It is necessary to remark that the term "acetic acid" in this table means the free acid of the beer, of which the amount was determined by saturation with carbonate of potass. The acid reaction of the beer is owing, however, mostly to the presence of lactic acid; and the presence of a perceptible quantity of acetic acid is generally indicative of the fact that the beer has already commenced to turn. Yet it cannot be denied that even the best beer contains traces of acetic acid.—*Archiven der Pharmacie*, xlvi., 146.

COMPOSITION OF GOOSEGREASE.

Gottlieb examined goosegrease. He found this fat composed of stearine, margarine, elaïne, and some butyric acid and caproic acid. He observed also that the mixture of stearic acid and margaric acid obtained by saponification of the fat, decomposition of the soap by means of sulphuric acid, compression of the separated fatty acids, solution of them in alcohol, and crystallization from this alcoholic solution, presents this remarkable singularity, that it melts at as low a temperature as 136.4 Fahr., and consequently at a lower temperature than margaric acid, which yet is the more fusible of the two acids constituting the mixture. Gottlieb prepared several mixtures of margaric acid with stearic acid in different proportions. He found that mixtures containing a preponderating amount of the stearic acid required for their fusion a degree of heat above 140° Fahr., whereas mixtures of equal proportions of the two acids, or with a preponderating amount of the margaric acid, fused below 140° Fahr.—*Büchner's Repertorium.*

ON THE PRODUCTS OF THE SODA MANUFACTURE.

By JOHN BROWN, Esq.†

Glauber first showed in 1658 that common salt could be decomposed by sulphuric acid. In the year 1736 Du Hamel proved the base of common salt to be soda. Previous to this, however, Cohausen, in 1717, had mentioned that salt might possibly be decomposed by means of lime; but, as this observation was associated with numerous errors, it was entirely overlooked. In 1737 Du Hamel succeeded in obtaining the alkali from sulphate of soda by fusing with charcoal, and digesting the fused mass in acetic acid, evaporating the acetate of soda thus formed to dryness, and calcining the residue.

Margraff endeavoured to decompose sulphate of soda by limestone, but without success. In 1768 Hagen showed that salt might be decomposed by means of potash, chloride of potassium and caustic soda being formed.

Bergmann succeeded in decomposing salt by caustic barytes.

In 1775 it was shown by Scheele that salt was partially decomposed by oxide of lead.

In 1782 Guyton and Carny decomposed salt by fusion with felspar.

In 1781 Constantini succeeded in decomposing salt by means of alum.

The sulphates of lime, magnesia, ammonia, potash, &c., decompose salt, as also iron pyrites.

To convert the sulphate of soda into caustic or carbonated alkali was, however, the process of greatest importance. The first step, namely, the conversion of soda into sulphuret of sodium, was known to Glauber, Stahl, Du Hamel, Margraff, and others. The difficulty was to get rid of the sulphur. Du Hamel effected this by means of acetic acid. But in the year 1784 the present process was discovered by Le Blanc and Dizé, and in the beginning of 1791 it was patented by Le Blanc. He used carbonate of lime to convert the sulphuret of sodium into carbonate of soda.

The proportions used by him were—

2 parts dry sulphate of soda,
2 " carbonate of lime,
1 " ground charcoal.

These were intimately mixed and introduced into a reverberatory furnace, where a strong heat was applied to it. After this had been continued for about an hour, the fused mass was raked out of the furnace and allowed to solidify. When this cooled it was broken up and exposed to the action of moist air, which caused it to crumble down. In this way the caustic soda was converted into carbonate of soda, the carbonic acid being derived from the atmosphere. After being ground it was ready for use.

The soda process, as at present carried on, will be best considered under the four following heads:—

1. The production of sulphate of soda from salt and sulphuric acid.
2. The conversion of sulphate of soda into crude carbonate of soda or British barilla.
3. The soda-ash process.
2. The carbonate of soda process.

I. The first stage which thus comes under our consideration is—The decomposition of common salt by sulphuric acid, causing the formation of sulphate of soda and muriatic acid.

The salt used in this process is obtained from the brine-springs of Cheshire, which exist abundantly in the new red sandstone of that county. The solution is evaporated till it reaches a certain strength, when all the salt precipitates; it is then raked out into wicker baskets, and allowed to drain. The mother liquor is used for the manufacture of the salts of magnesia. The salt thus obtained contains, as might be expected, numerous impurities, the principal of which are lime, sulphuric acid, and magnesia.

To estimate the lime a portion of the salt was dissolved in water, and, after separating the insoluble matter by filtration, the lime was precipitated by ammonia and oxalic acid, a large quantity of muriate of ammonia being added to retain the magnesia in solution.

	CaO, CO_2.	CaO.	CaO per 100 grs.
2000 grains of salt gave ..	15.10	8.456	4.228
2000 grains of salt gave ..	14.60	8.176	4.088
		Average ..	4.158

The sulphuric acid was precipitated by the addition of nitric acid and nitrate of barytes.

	BaO, SO_3.	SO_3.	SO_3 per 100 grs.
2000 grains of salt gave ..	39.85	13.738	6.869
2000 grains of salt gave ..	39.50	13.620	6.810
		Average ..	6.838

The quantity of magnesia was ascertained by precipitation by ammonia and phosphate of soda, the lime having been previously separated.

	$2MgO, P_2O_5$.	MgO.	MgO per 1000 grs.
2000 grains of salt gave ..	4.65	1.660	0.830

The carbonate of lime remained as insoluble matter when the salt was digested in water, and was separated by filtration.

	CaO, CO_2.	CaO, CO_2 per 1000 grs.
2000 grains of salt gave ..	3.000	1.50

By estimating the amount lost by drying the salt at 212° the quantity of water was ascertained.

		Water per 1000 grs.
330.2 grains of salt lost	17.96	54.373

In order to estimate the quantity of iodide of potassium and bromide of magnesium, 1½ lb. of salt was put into a funnel, the lower end of which was closed with filtering-paper. The salt was then repeatedly washed with boiling water. The iodide and bromide were thus taken up by the water along with a large quantity of common salt. The solution was evaporated to dryness and the residue digested in alcohol, which dissolved the iodide and bromide along with a little of the salt, leaving, however, the greater part of it, which was afterwards separated by filtration. The filtered solution was again evaporated to dryness and the residue digested in water. Chloride of palladium was then added, but no precipitation of iodide of palladium took place. The palladium was precipitated by sulphuretted hydrogen, and the sulphuret of palladium thus formed separated by filtration. Upon testing the filtered solution with ammonia and nitrate of silver, no precipitate was obtained. Had bromine been present, it would have been precipitated in combination with the silver, bromide of silver being insoluble in caustic ammonia. It is, therefore, evident that the common salt manufactured, as previously mentioned, does not contain iodine or bromine, although it is highly probable that these bodies are present in small quantity in rock salt; and we might, therefore, be able to detect them in the brine from which the magnesia salts are manufactured.

Upon treating the salt with bichloride of platinum a slight precipitate of potassio-chloride of platinum was obtained.

COMPOSITION OF COMMERCIAL SALT.

		Magnesia.	Lime.	Sulphuric Acid.
Chloride of sodium	931.615			
Chloride of potassium	trace			
Chloride of magnesium	1.066	0.381		
Sulphate of lime.	10.098	..	4.158	5.940
Sulphate of magnesia	1.348	0.449	..	0.899
Carbonate of lime	1.500			
Water	54.373			
	1000.000	0.830	4.158	6.839

About 6 cwt. of this salt is introduced into an iron pot, and upon this is run, by a syphon, about 5½ cwt. of sulphuric acid of about 1.750 specific gravity (150° Twaddell). A violent action immediately takes place, and large quantities of muriatic acid gas are evolved, which pass off by a chimney. If, however, the muriatic acid can be made use of, the gas is absorbed either by passing it through water contained in large cylindrical vessels or through a column of coke, which retains the gas until a considerable quantity of it is collected; a stream of water is then allowed to trickle through the coke, and in this manner all the gas is absorbed. At the expiration of about two hours the evolution of gas ceases; and the sulphate, which is in a semifluid state, is removed to another chamber, where it is strongly heated, in order to drive off

* Brohian is a species of white beer (resembling ale in colour), the intoxicating properties of which are slight indeed.

† From the Philosophical Magazine.

the whole of the acid. The whole operation takes about four hours.

The foreign matters contained in the sulphate of soda thus obtained are sand, peroxide of iron, magnesia, and undecomposed salt.

To estimate the sand. This remained as insoluble matter when the sulphate was digested in water containing muriatic acid, and was separated by filtration.

1000 grains of sulphate of soda gave	2.82	grains of sand.
" "	3.38	"
Average ..	3.10	"

From the solution filtered from the sand the peroxide of iron was precipitated by ammonia, muriate of ammonia having been previously added to retain the magnesia in solution.

1000 grs. of sulphate of soda gave....	2.15	grs. peroxide of iron.
" "	2.45	"
Average ..	2.30	

After separating the sand and peroxide of iron, as mentioned above, the lime was precipitated by oxalic acid and caustic ammonia.

	CaO, CO_2.	CaO, SO_3.
1000 grains of sulphate of soda gave	7.000	9.656
" "	7.367	10.019
" "	7.100	9.520
Average..		9.731

The solution thus freed from lime, &c., was treated with ammonia and phosphate of soda.

	$2MgO, P_2O_5$.	MgO, SO.
1000 grains of sulphate of soda gave	2.70	2.893

The quantity of chloride of sodium was ascertained by precipitating the chlorine by nitrate of silver and nitric acid.

	Ag Cl.	Na Cl per 1000 grs.
200 grains of sulphate of soda gave ..	4.30	8.995
1000 " "	29.70	12.373
500 " "	13.80	11.500
Average..		10.956

The sulphate of soda always contains a small quantity of free acid, the amount of which was ascertained by determining the weight lost by heating to redness.

		Per 1000 grs.	
200 grs. of sulphate of soda lost.... .	1.70	8.50	grs. free acid.
" "	1.84	9.20	"
Average...		8.85	

Composition of Crude Sulphate of Soda.

Sulphate of soda	962.170
Sulphate of lime	9.731
Sulphate of magnesia	2.893
Chloride of sodium	10.956
Iron peroxide	2.300
Sand	3.100
Free acid	8.850
	1000.000

[*To be continued.*]

California Gold at the Mint.—A letter has been received from Philadelphia, under date of December 9, which states that the writer had just witnessed the melting into bars of a large quantity of gold deposited there on Friday last by Mr. Carter, who had recently returned from the mines in California. He had deposited about 300,000 dollars' worth in scales and lumps, such as the agent of the War-office had carried on to Philadelphia. It had not yet been assayed, but from its appearance it leaves (as it comes from the furnace) the impression at the mint that it is about equal in value to our gold coin, ounce for ounce. There can no longer be any doubt of the genuineness of the gold. The process of assaying would probably be completed in the course of Monday, after which its results will, we presume, be duly published.—*Washington Union.*

THE CHEMICAL TIMES.

SATURDAY, JANUARY 27, 1849.

OUR OWN SERIES.

No. VI.

ON CHEMICAL MANIPULATION.

On the Working of Indiarubber.

The young chemist may consider that he now knows as much of the theoretic art of glass-working for all practical purposes in the laboratory as it is profitable to impart by mere description. Of course it is answered that he is not content with mere reading, but that he sits down to his blowpipe-table and reduces to practice our instructions. This being done, he will be sure to become an expert blowpipe operator.

We, therefore, think it unnecessary to expatiate further in this direction, and will proceed to develop another portion of manipulative chemistry. Next in order to an acquired facility of glass-working is, in our opinion, the method of taking advantage of the adaptive properties of indiarubber, a method which we shall proceed to describe.

The substance indiarubber or caoutchouc—which in Paley's days was so precious that a guinea per ounce was considered a cheap payment—has for some time, as our readers are aware, been vastly cheapened and extended in its applications. We have only to consider its adaptation to the wants of chemists.

This material is used in chemical laboratories in the condition of bottles, of sheets, or of solution, each of which conditions will demand our regard. Formerly, when the plan of working indiarubber was imperfectly developed, the natural bottles of that subtance, as they arrive from South America, were made into gas-containing bladders by a rather laborious and imperfect adaptation; they were boiled in water until they became soft, when the gas was injected by a syringe to the desired amount, and the resilient force of the indiarubber bag sufficed for its ejection. To this operation there were certain disadvantages, the chief being that the bottle was generally so unequal in thickness that unequal expansion, nay, frequently rupture, took place.

At this period, when vulcanized indiarubber bags,—hereafter to be treated of,—can be so easily procured, it is hardly worth while to treat further concerning the former somewhat inefficient contrivances.

When elasticity of a bag is not desired, but mere tightness, combined with flexibility, macintosh bags are frequently of great value,—and, indeed, are commonly employed for the purposes of the oxyhydrogen light. The macintosh tissue consists, as is well known, of two layers of cloth, each smeared with indiarubber varnish, superimposed face to face, and pressed together by means of rollers.

Although the manufacture of macintosh cloth is a commercial operation, yet, as the chemical manipulator will frequently have to imitate its preparation on a small scale, some notice of the details of its manufacture will be desirable, particularly as most persons, by following presumed analogies in this matter, generally fail.

Caoutchouc, although soluble in many menstrua, can only be reduced to the condition of a profitable varnish by means of a fire: of these coal naphtha is one, and a mixture of the latter with turpentine another.

Either of these, particularly if aided by turpentine, will easily dissolve indiarubber; and the result, a tenacious jelly, is the varnish with which macintosh tissues are prepared.

If this varnish be laid on to the extent of two or more layers upon two pieces of cloth, and the two varnished faces brought into apposition under pressure whilst wet, as is usual in other cases where agglutination by pastes is effected, it is clear that evaporation of the menstruum cannot go on, and, therefore, the tissues can neither dry nor adhere. The great art of practice, therefore, consists in allowing the menstruum to evaporate to such an extent that the film of indiarubber left is merely a little sticky, which condition having been arrived at, the two pieces if brought together will perfectly adhere.

This rule of practice the manipulative chemist should never forget; and it applies no less to solutions of indiarubber than to those of gutta percha.

The sheet indiarubber, hereafter to be treated of, and now so generally used in laboratories for the purposes of making joints air-tight, is, in some cases, hardly strong enough to withstand the internal pressure of gases or liquids, in which cases it should be reinforced by winding round it a strip of cloth cut from a piece kept in the laboratory, and prepared according to the following directions.

A piece of thin jean, having been laid thoroughly flat and even upon a table, or other flat surface, is to be smeared evenly over with a solution of indiarubber, by means of a spatula, and dried by exposure to a heat of about 80° Fahr.: when dry another coat is to be superimposed, and afterwards a third. This last coat having become dry, the operation is complete, and the cloth should be turned, in order to repeat a similar operation on its reverse side.

Thus will be made a tissue most valuable for binding together pieces of apparatus, and it may either be used alone, or, what is in general better, over a binding of sheet caoutchouc.

The tissue if rolled up alone would necessarily stick together, and could never be unfolded: it should therefore be covered with a flat piece of paper something larger than its own dimensions, and both should be rolled up together. Thus prepared, it may be kept any length of time without sticking together or otherwise spoiling, and it will be ready for immediate use on any occasion, nothing more being required than to heat it before the fire, and to wind it tightly round.

As may be imagined, it is not very elastic, although considerably more so than the unvarnished texture. This want of elasticity, however, is amongst its principal advantages.

THE CALIFORNIAN GOLD MINES.

When the first news of the discovery of vast fields of gold in California reached Europe, we

felt greatly inclined to look upon the flaming accounts transmitted to us in the American journals as the offspring of Brother Jonathan's lively imagination, and resting upon very weak foundations indeed.

Since then, however, official reports and authentic information have greatly shaken our original disbelief, and we begin to think that, after all, Brother Jonathan's first statements and surmises, extravagant though they appeared at the time, may in the end fall short of the momentous results that may be expected to arise from an extensive and well-organized exploitation of the gold fields of California.

According to the last accounts the average yielding of the territory in actual exploitation amounted to 100,000 dollars per day, which makes per annum the very large sum of about £7,500,000 sterling.

If we take into consideration that the number of individuals employed in the digging and washing of the gold does not as yet exceed from 6,000 to 7,000, and that their implements are of the most primitive kind, the amount of gold obtained by them is positively startling, and, to our apprehension, alarming.

A great many arguments have been advanced of late to prove that the discovery of this modern El Dorado, and the harvest of the golden fruits of its soil which it is likely to bring forth, will not materially affect the gross amount of the circulating medium, and, accordingly, hardly interfere with the market value of gold and the balance of the exchanges. In support of this opinion it is adduced that the actual gross amount of circulating medium in the world reaches the enormous sum of £2,400,000,000, and that the present annual increase of the precious metals, though amounting to between ten and twelve million pounds (according to some authorities on the subject), never exercises the slightest depressing influence upon the respective value of these metals. This may be very true. But, if the gold fields of California continue to prove so exceedingly fertile as they would seem at present, the increase in the amount of gold alone from that quarter will very soon double and treble the total amount of the actual annual increase of the precious metals. If, with partial working and imperfect implements, a small portion of the gold fields yield a harvest of from seven to eight million pounds per annum, it will not be too much to calculate upon a future return of even twenty to twenty-five millions per annum (continuing for a less or greater number of years), when a well-organized system of exploitation shall have been introduced; and this enormous quantity, thrown into the market within a comparatively short space of time, must inevitably tend to depreciate the value of the metal most seriously. Nay, it is not altogether impossible but that in the course of time the relative proportions of gold and silver may undergo a total change—that silver may, in fact, replace gold as the great medium of commercial exchange.

What would be the influence of a considerable reduction in the price and value of gold upon arts and manufactures? This question may, perhaps, ere long, present itself as something more than a mere speculation.

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON JAN. 24, 1849 :—				
In London and vicinity, viz. :—				
Whitechapel	1			
Westminster	1	1		
St. Pancras workhouse	1	1		
Kensington	3	1		
Battersea (Althorpe-house)	1	1	5	
In the country, viz. :—				
East Reedham, Norfolk	4			
Carlisle	1			
Wakefield	3	2		
In Scotland, viz. :—				
Edinburgh	5	1	2	
Glasgow	94	35	73	
Selkirk	4	1		
Old Monkland	37	23	12	
Greenock	2	3	1	
Melrose	3	1		
Jedburgh	1			
Dunoon	1	1		
Newmilns and Loudon	4	1		
Tulliallan, Kincardine	2	1		
Doune	1			
Mauchline	4	2		
Total new cases	175	75	93	
In London and vicinity	808	446	116	246
In the country	585	272	70	243
In Scotland	7461	3243	1932	2286
Total	8854	3961	2118	2775

THE BILLS OF MORTALITY.

The return of the births and deaths registered in London during the week ending Saturday, Jan. 20, states the number of births as 1,528, and the number of deaths as 1,345. From this latter statement it appears that a rate of mortality prevails considerably above the average of the five previous winters, the excess being 176. As compared, however, with the return of the preceding week there is a decrease of 103—a fact which the Registrar-General notices in connection with the mean temperature of the air, which rose during the period from 39° to 47°. Of the deaths registered in the return 393 were from zymotic diseases, being 172 above the average. From dropsy, cancer, and other diseases of uncertain or variable seat, the deaths were 61, the average being 54; tubercular diseases, 155, average 203; diseases of the brain, spinal marrow, nerves, and senses, 136, average 141; diseases of the heart and bloodvessels, 55, average 40; diseases of the lungs and other organs of respiration, 300, average 243; diseases of the stomach, liver, and other organs of digestion, 68, average 67; diseases of the kidneys, 15, average 13; childbirth, &c., 14, average 9; rheumatism, &c., 7, average 7; malformations, 1, average 3; premature birth, 24, average 23; atrophy, 23, average 16; age, 59, average 73; sudden, 13, average 14; violence, privation, and intemperance, 20, average 37. In the details of these items it is stated that of men and women at the age of 60 and upwards, 307 sunk under disease or the weight of years, or about 100 more than died weekly before the cold weather set in at the beginning of this month. The deaths caused by bronchitis and pnuemonia were 248, and exceed the winter average by 67. Small-pox was fatal to 30 persons, or 9 more than the average; scarlatina to 87, the average being 32; typhus to 68, the average being 42; whooping-cough to 58, the average being 42. The mortality from measles, which was fatal in only 8 cases, is less than one third of the average. The deaths from diarrhœa and dysentery were 28, which is more than usual at this season of the year; from cholera 62, of which 27 occurred in Mr. Drouet's establishment—6 among children who had been removed from it, and 29 amongst other inhabitants of the metropolitan districts. A man died in the sub-district of Rotherhithe of "fever from cold and poor living," according to medical certificate. No inquest appears to have been held on the body.

The following is a statement of the fatal cases of cholera registered during the week :—

KENSINGTON; Town.—In the workhouse, M. 5, "exhaustion consequent upon the mortal effects of fever after an attack of cholera"—inquest. In Jenning's-buildings, daughter of a farrier, 2, "cholera (12 hours);" in same buildings, daughter of a farrier, 5, "cholera (26 hours);" in same buildings, wife of a labourer, 33, "malignant cholera (9 hours)." Mr. F. Gorham, the registrar, states that "The boy mentioned above was one of 23 children who had been removed from Drouet's school at Tooting. Of this number 16 have been attacked by the disease, but, owing to careful treatment, only two cases have proved fatal. Jenning's-buildings, where the other cases occurred, is the resort of the poorest class of persons (principally Irish) in the district. In many cases there are as many as seven or ten persons living constantly in a single room, and, when their filthy habits and want of proper food are considered, it is matter of surprise that cholera has not sooner made its appearance among them."

CHELSEA; North-West.—In the workhouse, M. 22, "cholera (20 hours), fever and relapse (2 months);" M. 77, "bilious cholera (3 days)."

ST. PANCRAS; Camden-town.—In St. Pancras workhouse, M. 11, "Asiatic cholera (3 days);" in same workhouse, M. 7, "Asiatic cholera (32 hours);" in same workhouse, F. 64, "cholera;" in same workhouse, F. 9, "Asiatic cholera (26 hours);" M. 5, "malignant cholera, the cause thereof not traceable"—inquest; F. 7 months, "malignant cholera, the cause thereof not traceable"—inquest; M. 3, "cholera (36 hours)." Mr. B. Holl, the registrar, states that "The three children who died in the workhouse had been brought from Tooting while under the influence of the disease. The woman, aged 64, died in the infirmary of the workhouse, a building quite unconnected with that part of the house which the children occupied, and not allowed to have any communication with it. The deaths of the other three children occurred in a narrow court which runs out of the Pancras-road through the Wheatsheaf public-house into Spann's-buildings. They had been in good health and condition previously to the attack; and Dr. Quain, who made a *post-mortem* examination, states that there was no symptom of their having suffered otherwise than from the disease of which they died."

HACKNEY; Hackney.—F. 50, "Asiatic cholera (30 hours);" F. 11, "Asiatic cholera (18 hours); low consecutive fever (3 hours)." Mr. Steib, the registrar, states "That the former was a decided case of Asiatic cholera in a servant who belonged to the Islington poorhouse, and had been brought to Hackney to nurse the sick children. The second was another decided case in a girl belonging to the Islington poorhouse, who had been brought to Hackney from Drouet's asylum at Tooting."

HOLBORN; St. Andrew, Holborn.—M. 56, "Asiatic cholera (16 hours);" M. 57, "malignant cholera (18 hours)"—inquest; M. 29, "malignant cholera (2 days)"—inquest.

WHITECHAPEL; Church.—In London Hospital, M. 52, from Denmark, "Asiatic cholera (18 hours)." Goodman's-fields.—At Front-change, Rosemary-lane, F. 14, "Asiatic cholera (28 hours)." At 88, Leman-street, wife of a la-

bourer, 48, "cholera (24 hours)." Aldgate, F. 48, "Asiatic cholera."

St. Olave; St. Olave and St. Thomas.—In hospital, on the 16th of January, from Greenwich, Greenwich Railway guard, 38, "morbus cerebi; laryngitis; pneumonia; morbus Brightii; cholera."

Newington; Walworth.—At 6, North-street, Walworth, son of a shoemaker, 4 months, "cholera (1 day), convulsions;" in Newington workhouse, M. 10, "cholera (30 hours);" parents unknown. Mr. Turner states that "This boy had been removed from the establishment at Tooting, and his death is the second that has occurred since the return of the children to Walworth. Some others have been attacked, but are now doing well."

Lambeth; Waterloo, second part.—F. 2, "cholera (12 hours)." Church, first part.—F. 2 months, "cholera (2 days)." Stated to have been ill two days, but was seen by the medical man only nine hours before death.

Wandsworth and Clapham; Wandsworth.—M. 9, "cholera (13 hours);" M. 8, "malignant cholera (48 hours);" M. 39, "cholera (15 hours);" F. 8, "cholera (23 hours);" F. 76, "cholera (14 hours)." Battersea.—At Church-street, cordwainer, 50, "cholera (9 hours);" in union workhouse, nurse, 63, "malignant cholera (24 hours)."

Wandsworth and Clapham; Streatham and Tooting Graveney.—The following list contains all the deaths registered in the week, amounting to 36, which occurred in Mr. Drouet's Poor Establishment, Surrey-hall, inclusive of 9 certified as caused by typhus, mesenteric disease, and congestion of the brain. The total deaths registered in this and the two previous weeks which have occurred in the institution, or amongst children who have been removed from it since the appearance of the epidemic, amount to 182, of which 155 were returned as caused by cholera, though it is probable that most of the others were also connected with the epidemic:—M. 8, "cholera (20 hours);" F. 6, "cholera, consecutive fever (5 days);" M. 10, "cholera (3 days), typhoid fever (8 days);" M. 13, "cholera, consecutive fever (7 days);" M. 8, "diarrhœa (4 days), cholera (2 days);" F. 9, "cholera (24 hours), typhoid fever (3 days);" M. 4 "cholera (12 hours);" M. 12, "cholera (18 hours);" F. 3, "cholera (3 days), debility (4 days);" F. 7, "cholera (2 days), typhoid fever (3 days);" F. 7, "cholera (3 days), debility, scrofulous constitution;" F. 2, "cholera (72 hours);" M. 10, "cholera (24 hours);" F. 8, "cholera, exhaustion (5 days);" F. 11, "cholera (36 hours), typhoid fever (4 days);" M. 12, "typhoid fever, debility (3 weeks);" M. 6, "mesenteric disease (some weeks), debility (some weeks);" M. 8, "congestion of the brain (3 days);" M. 13, "typhoid fever (3 weeks);" M. 6, "cholera (6 days);" M. 8, "cholera (3 days);" M. 14, "fever (7 days), debility;" M. 13, "cholera (3 days), typhoid fever (4 days);" M. 6, "mesenteritis, debility (some weeks);" M. 8, "cholera (3 days), consecutive fever (9 days);" M. 5, "cholera (5 days);" F. 6, "cholera, relapse (7 days);" M. 10, "cholera (2 days), consecutive fever (5 days);" M. 13, "cholera (2 days), consecutive fever (8 days);" F., nurse in Mr. Drouet's establishment, 54, "typhus mitior (14 days);" M. 7, "typhoid fever (10 days);" F. 5, "cholera (3 days);" F. 8, "cholera, typhoid fever;" F. 4, "mesenteritis (13 days), debility;" M. 10, "cholera (4 days), typhoid fever (9 days);" M. 12, "cholera (3 days), incipient phthisis (14 days)."

SANITARY MEASURES IN THE CITY OF LONDON.

The first meeting of the Commissioners of Sewers of the city of London under the new act of Parliament took place, at Guildhall, on the 23d inst.

The meeting was very numerously attended, much interest having been excited by the appointment of the various officers of the court, the general business connected with the sanitary regulations, and the reports of Mr. Simon, the City medical officer, and others, relating to the necessary arrangements to be made to meet future emergencies.

In the course of the sitting Mr. Simon, the new City medical officer, read a long and interesting report respecting the present rate of mortality in the City (which he estimates at about 28 per 1,000 per annum of the population); the defective sanitary arrangements of certain districts (particularly the courts which lie between Snow-hill and West-street, Smithfield; those which open into Long-lane, and, worst of all, those which lie about Moor-lane, Milton-street, Whitecross-street, and Golden-lane, in the ward of Cripplegate); and the sanitary clauses of the new act, by the enforcement of which he considers that the commissioners had within their control as good an antidote for the spread of fever as vaccination is for the infection of smallpox. With respect to the 80th clause, which legalized his appointment and assigned his duties, Mr. Simon solicited the attention of the commissioners to the very serious difficulty which must attend all sanitary progress in the City, unless in the very first instance a perfect spirit of co-operation was established among the various authorities who are interested in that progress. Reference to the clause in question (he said) will show that it must often be the duty of the officer of health to suggest measures for the improvement of the general condition of the poorer classes, or for the relief of some temporary pressure of disease, or for the arrest of infection; and, although the indulgence of this court might, perhaps, be so far extended as to allow him to broach such topics in that place, yet it was obvious that his doing so would often lead to inconvenience, and seldom to advantage. Cases might often occur (and, indeed, are now occurring) in which clause 80 contemplated and required the interference of the officer of health; but in respect of which the clause omits to indicate with what authority or by whose intervention he can act. In all those large and important works which do so much towards annihilating the physical causes of disease, in all which relates to the drainage and purification of the City, that hon. court was quite absolute; but, for what relates to the personal circumstances of the sufferers, or the measures that may be requisite for their relief, the court has declined to provide in its act of Parliament. Most of the cases to which he alluded to were within the jurisdiction of the guardians of the poor, and he would respectfully beg the hon. commissioners to instruct him how, in such cases, they would wish him to proceed. In the event of a board of health being formed as a body, with which he might habitually act, it would no doubt be within the power and discretion of the commissioners, and would be of infinite advantage to the despatch of business, if arrangements could be made to avoid those conflicts of jurisdiction which might at some most critical moment render his best endeavours ineffectual. Meanwhile, if that hon. court should be pleased to sanction it, he would propose that a formal notification of his appointment should be conveyed to the several boards of guardians, and that he should be permitted to add to this notification that, in the event of occasion requiring it, he should (according to the spirit of the clause referred to) consider himself bound, and at the same time authorized by that hon. court, to co-operate, to his best ability, in such sanitary movements as the guardians might originate.

Upon the motion "that the statement be printed and circulated," it was objected by some members that alarm might be excited by the dissemination of the truths contained in it; but it was almost unanimously agreed to that the sooner so important a document met the public eye the better; and the motion was carried by acclamation.

Papers from the several City unions were referred to the Board of Health.

A communication from Mr. D. W. Harvey, calling attention to certain returns, which he had transmitted, respecting numerous nuisances reported by the police as existing within the city of London, was also referred to the Board of Health. The following is the most important part of the communication:—

"The principle I propose to establish is that of sleepless superintendence over the various departments of water, gas, fire, and air, in whatever can preserve health or promote comfort, to be effected by the daily inspection of each and all of the highways and by ways of the City—its streets, lanes, alleys, and courts, to the end that no nuisance or danger shall be allowed to continue; that the advantages of water and light be uniformly and amply supplied; and, that the inhabitants of the City of every condition may enjoy the full benefit of this system of generous protection, notices should be periodically left with every dweller, inviting attention to our arrangements and co-operation in their observance, so that in effect no just cause of complaint should escape detection or elude redress. To carry out in the most effectual manner a system so fraught with public utility and individidual comfort, I propose to assign to the fittest members of the establishment their allotted duties, and to make a weekly report to the commissioners of sewers of every occurrence which can be suggested by vigilant attention to the objects I have enumerated."

The returns transmitted by Mr. Harvey were made in districts corresponding with the police divisions, and embraced nearly 200 cases, many of them of long standing and of aggravated character, and all deserving of attention.

Gore, the dust-contractor, was fined £5 for not removing the filth in Smithfield.

MISCELLANEA.

CHEMICAL PATENTS RECENTLY ENROLLED.

William Edwards Staite, of Lombard-street, City, gentleman, for improvements in the construction of galvanic batteries, in the formation of magnets, and in the application of electricity and magnetism for the purpose of lighting and signalizing; as also a mode or modes of employing the said galvanic batteries, or some of them, for the purpose of obtaining chemical products. Patent dated July 12, 1848. Enrolled January 12, 1849. (Partly a communication.)

The great leading feature of this invention being the batteries, they obviously form the first part of the specification; the system pursued throughout being what the inventor terms the "perfluent" system in contradistinction to the percolating batteries—the unequal reduction of the plates by these (as well as every other kind of battery), besides the constant attention required, rendering them all more or less troublesome and expensive in their action. Now, by the proposed system the consumption of the metal is equalized, and the exciting fluids may be regulated so as to effect the necessary change to ensure the continued action of the battery without other attention than may be periodically determined, and which may be extended to a considerable time. These batteries are, in their general arrangements, very similar to the ordinary acid battery; each separate cell is furnished with two openings at bottom, at opposite ends of the cell, which communicate with short longitudinal channels under the battery, which connect one cell with that next it on one side, while the opening or channel at the other end of the cell communicates with the adjoining cell on the other side; and in this order the whole series are in communication. The under channels, leading to the end cells of the battery, have a hose attached thereto, which are carried up to the level at which the liquid is to stand in the battery, and terminate in two funnel heads—the one having a spout to run off the excess of the liquid into a suitable receiver, while the

other is being continually replenished from the supply cistern; the height of this funnel being sufficient to cause the liquid to flow through the battery, passing first to the cell next that end in which it circulates, then to the next in succession by channels before mentioned, and so on through the whole series. Modifications of this battery are represented, in which only one opening is made in the bottom of each cell, and all communicating with one channel. A hose pipe is attached to this, the funnel head of which is raised and lowered at intervals of about twenty minutes, for the purpose of running off or replenishing the liquid, which is thus equalized throughout the whole number of cells. Instead of the cells being connected at alternate ends, as first described, syphons may be employed for passing the fluid from one to the other. In another arrangement the perfluent system is shown in connection with a double or porous cell battery (the inner cell being a porous jar), supported in the centre of the outer cell on a pipe passing through the bottom of the battery and furnished with washers of indiarubber, to prevent the liquid escaping from one cell to the other; or at the bottom this pipe forms a communication with an under supply channel, in which the proper feed is maintained in a hose and funnel head, at the proper level; and, supposing the exciting liquid to be a solution of sulphate of lead, it becomes specifically lighter while it remains in the jar, and becomes a clear solution of dilute sulphuric acid. This is allowed to flow over the edge of the porous jar into the outer cell, or zinc compartment of the battery; here it escapes by an aperture in the bottom to a channel common to all these cells, and from thence carried away by it at a height suitable for maintaining the proper level in the cells.

The second part of this invention alludes to an apparatus for regulating the supply of the exciting fluids to galvanic batteries. The liquid is contained in a cask or other suitable cistern, enclosed at top to prevent the pressure of the atmosphere acting on the surface of the liquid, which is drawn off at an opening at the bottom, and received into a small open cistern, the level of the liquid in which, when above the opening in the cask, prevents any further escape; from this small cistern the liquid is drawn by means of a syphon; the end pendant thereon is a flexible hose: while the other, or long end, is a metal tube, which delivers the liquid into a glass tube or vessel, from which it escapes by a small aperture at the bottom, which is regulated to pass about the necessary quantity; when the liquid rises to a higher level in the glass tube, and consequently covering the long end of the syphon, which passes to the bottom, the flow will be diminished, at the same time the higher level attained will indicate a greater outflow at the bottom; the outer side of the glass being graduated accordingly. The syphon is suspended by a cord, by which the relative proportion of the legs may be varied by elevating or depressing the level thereof, the long end always remaining the same, while the flexible material of the other adapts itself to the required height at which the apparatus may be suspended.

Thirdly. This invention relates to combination of lead as the positive element with nitric or acetic acids, instead of zinc, and having any suitable negative element, the plates for which purpose may advantageously consist of surfaces of platinum.

Fourthly. To the employment of an amalgam of zinc, enclosed in a bag, as a substitute for the amalgamated zinc plates or rods used in galvanic batteries. For this purpose he employs a bag of linen, haircloth, or any finely-reticulated fabric not metallic, in which the amalgam (in a liquid state) is placed, in which state it is used in lieu of the plates before mentioned.

Fifthly. To improvements in the formation of magnets, which consist, first, in the hardening such articles by heating them in a bath of hot metal, instead of subjecting the magnet to the heat of a furnace, and afterwards plunging them in water—lead being employed as the heating medium.

The metal he uses in the formation of magnets for electrical purposes he prepares as follows:—He takes the best Swedish iron, and, instead of converting the whole of it into steel, as usual, he only partially converts it to the thickness of the scale on the outside; this scale is removed, and afterwards fused and the ingot obtained, and then rolled out into thick sheets, from which the magnets are cut.

The sixth part relates to an improved galvanometer; in the galvanometers hitherto employed they have been useless when the electrical apparatus has been in action, as they cannot be used during that time, while the present improved galvanometer is included in the circuit, and shows at all times the intensity of electricity passing. It consists of a thick wire coiled round a hollow wood centre, in which a glass tube is fixed, in the centre of which is placed a rod of soft iron, so as to slide freely up and down in the centre. This is surmounted by a small stem of brass; the passage of the current through the coil tends to draw the soft iron rod upwards, the height to which it is elevated depending on the intensity of the current; the glass tube is graduated to show in units the number of grains of pure zinc consumed, which may be effected by actual experiment, or it may be graduated according to one of Petrie's galvanometers.

The seventh part relates to an amalgam consisting of zinc and mercury, in the proportion of five parts of the former to one of the latter, when employed as plates or rods in galvanic batteries.

The eighth part of this invention has reference to improvements in effecting the motion of the electrodes in electric lamps employed for the purpose of producing a continuous light for illuminating purposes, or for the production of a regular intermittent light applicable to light-houses. The improvements in this particular consist of an apparatus for elevating the electrode as it is consumed or transferred to the opposing electrode by the passage of the electricity, and is an improvement on a former patent, dated July 3, 1847, and described in No. 86 of "The Patent Journal." In this case the supporting stem of the lower electrode terminates at the lower end in a rack, which gears into a pinion, on the axis of which is placed an escapement-wheel, worked by means of a double pall, one of which drives the wheel in one direction, while the other propels it in the opposite direction.

This double pall is pivoted in the centre (the opposite ends being the parts that fall into the teeth) to a lever, one end of which has a slow oscillatory motion communicated to it from a crank, actuated by a train of wheelwork, the motion of which is maintained by springs, or some suitable maintaining power; and the direction of motion given to the wheel will depend upon the pall in gear; this is determined by what he terms a regulator-coil; this regulator-coil is placed in the circuit producing the light. A rod of soft iron is placed in a vertical position in the coil, the upper part of which terminates in a wooden top attached to a long lever, which is elevated or depressed by the vertical rod, according to the intensity of the current of electricity; the long lever has, near its fulcrum, a small stirrup, embracing one of the palls, so that when it is elevated it withdraws that pall from the wheel, and throws the other into gear; this will take effect when the lower electrode has been elevated too far, or brought into too close contact with the opposing electrode, and will, consequently, reverse the direction of motion of the wheels, and lower the electrode; and, again, when it sinks too low, the palls will be reversed, and thereby rising the electrode to a position more compatible with the production of light. When the electrodes are in a position the best suited for the production of light, a small catch on the regulator-rod lever comes in contact with the crank-movement, and prevents the further action thereof; but so soon as this lever is elevated or depressed by the regulator-coil, so will an upward or downward motion be imparted to the electrode. Suitable counterbalances are attached to the several parts, to ensure their proper action. By this means a continuous and uniform light is obtained applicable for general purposes of illumination. The upper electrode is secured in a tripod, one of the legs of which forms the conducting link, and is immediately connected with the regulator-coil before mentioned, and forming the eduction for the electric current, the induction being effected through the rack to the lower electrode.

In the production of an intermittent light the supporting stem of the electrode is furnished with a rack, gearing into a pinion, in connection with a train of wheelwork and a suitable flyer, to regulate the motion; this pinion is so fitted as to have about one tenth of an inch of backlash, and is free to receive an impulse from the rack. The lower end of the stem terminates in a rod of soft iron, surrounded by a helix-coil contained in the electric circuit. This is influenced by the current so as to draw down the electrode, the wheelwork before mentioned giving way thereto, and allowing it to be slowly withdrawn, so that when the electrodes are at too great a distance apart the light becomes extinguished, and the influence of the coil ceases. A weight hung over a pulley is suspended by a cord from the rack or support bar of the electrode, which—so soon as the influence of the coil ceases—begins to elevate the lower electrode, until it comes in contact with the upper electrode, and thereby establishing the electric circuit; and the influence of the coil being again brought into action, the rack bar is slowly drawn downwards, as before explained, till the light becomes extinct—the flyer in gear with the rack limiting the speed of either movement, producing thereby a regularly intermittent light, the duration of the light and the succeeding intervals of darkness depending upon the apparatus employed. A chain is attached to the raising weight, one end of which rests on the pedestal of the apparatus; and, as the electrode is reduced, a greater portion thereof is deposited on the resting-place, and so keeps the whole in a proper state of equilibrium. Other arrangements are represented for producing an intermittent light, in which the rack and wheel work is omitted, thereby allowing the flashes of light to be produced in rapid succession; but this may be readily arranged to limit the duration of light or darkness, as may be required. In one of the lamps shown the upper electrode consists of a rotating disc,* having an angular periphery, the apex of which forms, as it were, the point of the electrode. This is connected with suitable wheelwork, which causes it to rotate slowly, or about one revolution an hour. A scraper is placed in contact with the periphery of this disc, which removes at each revolution the particles of matter transferred from the lower electrode, and by this means maintaining a permanent point to the electrode.

The eighth part has reference to the making of electrodes of electric lamps of iridium, the hardest of all known metals; or of alloys thereof. For this purpose he fuses the oxide iridium by enclosing it in a cupel of bone-ash under the influence of the voltaic arc, which produces the most intense heat known. The resulting ingot is afterwards subjected to heat for a considerable time, and hammered for the purpose of annealing it, and forming as near the shape as possible when it is completed in the manner of cutting precious stones by the lapidary's wheel. These electrodes are shown in a shape assimilated to

* The improved rotating disc, as substituted for the stationary electrode, we believe to have been published some time ago in France as the invention of Chevalier Le Molt, which gentleman will also include in it his English specification due Jan. 20; the prior right to which, we understand, will be sustained by the drawings and specification deposited with the Attorney-General in the oppositions of the respective patentees. We see also by advertisement in the *Times* a claim put forth by Mr. Massi, of Noble-street, Goswell-street, as being the inventor of the perfluent system of battery; and, further, that he manufactures the same for sale—a tolerable good proof to the title.

that of a horse-shoe, and mounted on two glass supports from the base of the lamp, with which the current wires are in suitable connection; the whole is under a glass shade, the light being produced by the passage of the electric fluid through the iridium. Combinations of the electrodes are represented under the same shade for the production of a more intense light.

The ninth part refers to the encasing of electrodes in supporting tubes, by which the electrode is protected from fracture, and also admitting of the electrodes being made of several pieces, and joined end to end. This supporting tube rises nearly to the top of the electrode, and is surmounted by a number of erect springs, which surround the electrode, and hold it firmly after it passes out of the tube end; these springs are fitted to the top of the tube by a sort of bayonet joint. The electrode—or pieces forming the electrode—are joined by inserting the one into the other, and secured by a suitable cement, the top of the under one forming a cup for the reception of a pin formed on the lower end of the upper portion.

The tenth part relates to the introduction of an intensity coil in the electric circuit of galvanic batteries, for the purpose of increasing the intensity of the fluid. This consists of a copper wire ribbon, wound and retained in a suitable coiled form, through which the current is passed when applied to the purposes of lighting, or for motive purposes. This copper ribbon should be in cross section of an area of one tenth of an inch for every forty yards in length.

The last part of this invention relates to the production of chemical products from galvanic batteries, either used for the production of light or heat, for motive power, or for the production of such chemical products only. For this purpose one or the other of the perfluent systems of battery should be employed, from the facilities afforded for drawing off the products. In the case of zinc being used as the positive element, the sulphate of zinc will be the result; but, as the sulphate of zinc is of little or no commercial value, he further prepares it by adding thereto a solution of the sesquicarbonate of ammonia, which will precipitate the oxide of zinc, and the acid, being thus freed from the zinc, may be used again in the batteries, while the oxide of zinc may be employed in place of the carbonate of lead so extensively used as a pigment. Various other results may be obtained, according to the metals and acids employed in the batteries, several of which are given in illustration, but which it will be unnecessary to enter into.

First. The construction of galvanic batteries on the perfluent principle before explained; whether the perfluence of the liquid is effected by intercommunicating channels at the bottom of the trough, or by syphons at the top, or by any other equivalent means.

Secondly. The employment in galvanic batteries of flexible hose, with funnels attached thereto, for the purpose of charging and discharging the cells.

Thirdly. The construction of the double-fluid battery before described, so as to cause the perfluence of two separate and distinct exciting liquids.

Fourthly. The graduated meter attached to the supply-tub or cistern, in order to regulate the quantity of the exciting fluid which may be required to pass through the battery.

Fifthly. The equilibriated hydrostatic supply-cistern, as adapted to galvanic batteries.

Sixthly. The combination of lead (instead of zinc), as the positive element, with any suitable negative element having nitric acid as the exciting fluid, in galvanic batteries.

Seventhly. The mode described of enclosing a liquid mercurial amalgam of zinc in a bag of linen, horsehair cloth, or other finely-reticulated fabrics, and to be used instead of the amalgamated zinc plates or rods of galvanic batteries.

Eighthly. The employment of an amalgam of zinc and mercury, in the proportion of five of zinc to one of mercury, in galvanic batteries.

Ninthly. The several improvements described in the formation of magnets.

Tenthly. The improved regulator for electric lamps, as described.

Eleventhly. The improved galvanometer and graduated scale, before described.

Twelfthly. The several improved modes of actuating the electrodes in electric lamps, before described.

Thirteenthly. The method described of making the electrodes of iridium, or alloys of iridium, and used for the purpose of producing electric light.

Fourteenthly. The encasing the electrodes of electric lamps in tubes, for their support, and the making them in pieces, as before explained.

Fifteenthly. The insulation of the said electrode tubes from the metal stand which supports the lamp, so as to allow of two or more separate lights being worked with separate currents of electricity, independently of each other, but sufficiently near to be worked under one glass shade.

Sixteenthly. The revolving circular electrode, with conical edges, in combination with a scraper, for removing the particles of matter transferred from the one electrode to the other.

Seventeenthly. The employment in electric lamps of glass, or some similar imperfect conductor of heat, to envelop the metallic apparatus for holding the electrode.

Eighteenthly. The combination of an intensity-coil with a galvanic battery, as before described.

Nineteenthly. The several arrangements for producing the regularly intermittent light from electricity for the purposes of illumination in lighthouses, together with the various modifications by which the same may be adapted to the production of a permanent light, as described.

Twentieth and lastly. The formation of galvanic batteries for the purpose of obtaining chemical products from the several combinations of galvanic elements and exciting liquids, herein mentioned.

Antony Lorimier, of Bell's-buildings, Salisbury-square, City, bookbinder, for improvements in combining gutta percha and caoutchouc with other materials. Patent dated July 10th, 1848. Enrolled January 10th, 1849.

This specification relates to the production of certain compounds of gutta percha and caoutchouc, and consists:—First, of a mode of cleaning gutta percha, and separating from it the dirt and other extraneous matters combined with, but not adhering firmly to, it.

Secondly, of combining with gutta percha various substances for producing new compounds, to be employed in manufacturing various articles.

Thirdly, of combining with caoutchouc various substances, thereby producing new compounds; likewise for manufacturing various articles.

The first of these improvements is effected by the aid of machinery, which clears from the gutta percha those extraneous matters which may be combined with it, and thus to render it in a more fit state than hitherto to be afterwards combined with certain substances (which constitutes the second part of the improvements). It consists in cutting or slicing the raw gutta percha into thin shavings or slices, by means of revolving knives, of which the specification describes several arrangements. After being divided into these thin cuttings, they are placed in another apparatus, by which they are bent and teased about in all directions, so that the loose dirt and other impurities are separated from the gutta percha, and pass through a perforated bottom or grating, leaving the gutta percha in the machine in a clean and comparatively pure state. It is then removed to another apparatus, termed the "welding-machine," where the gutta percha is subjected to heat by means of steam. After being thus purified, the gutta percha is in a fit state to be combined with other matters and substances, and which forms the second part of the specification. The matters with which the gutta percha is to be combined are burnt flint and burnt clay, in fragments, broken pieces of earthenware, china, porcelain, marble, Portland and other stones, washed and sifted, being reduced to powder; also oxide of zinc, oxide of copper, hydrate of lime, and oxalate of lime; also lime slacked with water, in which oxalic acid has previously been dissolved; the proportions of this ingredient being about three pounds by weight of the acid to one bushel by measure of the lime; the water used being sufficient to slake the lime. Any one or more of these substances may be combined with the gutta percha, those substances being selected for the purposes best calculated to produce the articles desired. The mode described by the patentee for combining the materials together is to take a quantity of gutta percha and place it upon an iron slab or plate, heated by steam or any other convenient means, and then knead and roll it into thin sheets, when the before-selected materials to be combined with it are sifted over the surface of the sheet in small quantities; it is then rolled up, kneaded, and worked, and re-rolled out, and the matters again sifted over it as before; and this is repeated until a sufficient quantity of the matters are combined with the gutta percha, when it is to be rolled in sheets, or applied in any other way to the purposes required, as the making of soles for boots and shoes, belts, and bands, the proportion of the ingredients of the combination depending upon the purpose for which it is required.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING JANUARY 16TH, 1849.

Richard Laming, of Clichy la Garonne, near Paris, in the Republic of France, chemist, for improvements in the modes of obtaining or manufacturing sulphur and sulphuric acid. Patent dated January 13th, 1849; six months. N.B.—This patent being opposed by caveat, lodged at the Great Seal Patent-office, was not sealed till the 13th January, 1849; but bears date the 4th September, 1848, the day it would have been sealed and dated, had no opposition been entered. (By order of the Lord Chancellor.)

William Betts, of Smithfield-bars, in the city of London, distiller, for a new manufacture of capsules, and of a material to be employed therein, and for other purposes. Patent dated January 13th, 1849; six months.

George Williams, of Tipton, in the county of Stafford, forge-manager, for a certain improvement, or certain improvements, in preparing puddling-furnaces used in the manufacture of iron. Patent dated January 13th, 1849; six months.

Conrad Haverkam Grecnhowe, of the city of London, civil engineer, for certain improvements in atmospheric railways. Patent dated January 13th, 1849; six months.

Richard Dugdale, of Brompton, in the county of Middlesex, engineer, for improvements in hardening articles composed of iron. Patent dated January 13th, 1849; six months.

Anthony Barberis, of Leicester-square, engineer, for improvements in spinning silk, and in the construction of swifts, and in the arrangement of apparatus for winding silk, and other fibrous substances. Patent dated January 16th, 1849; six months.

Jean Baptiste François Mazeline Aine, of Havre, in the Republic of France, engineer, for improvements in steam-engines, and in the machinery for propelling vessels. Patent dated January 16th, 1849; six months.

William Martin, of St. Pierre les Calais, in the Republic of France, machinist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and also to printing, and other like purposes. Patent dated January 16th, 1849; six months.

Peter Augustine Godefroy, late of Shepton Mallett, Somerset, now of 31, Wilson-street,

Finsbury-square, chemical colour-manufacturer, for certain improvements in dressing and finishing woven fabrics. Patent dated January 16th, 1849; six months.

Edward Buchler, of the city of London, merchant, for improvements in the manufacture of boots and shoes; also applicable to other fabrics. Patent dated January 16th, 1849; six months.

Carey M'Clellan, of Larch Mount, in the liberties of the city of Londonderry, for an improved corn-mill. Patent dated January 16th, 1849; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Patent dated January 18th, 1849; six months.

John Francis Bottom, of Nottingham-park, Nottingham, lacedresser, and John Dearman Dunnicliff, of Hyson-green, Nottingham, lacemanufacturer, for improvements in dressing or getting up fabrics of cotton or silk, and of cotton and silk combined. Patent dated January 18th, 1849; six months.

Francis Alton Calvert, of Manchester, machinist, for certain improvements in machinery for cleansing and preparing cotton, wool, and other fibrous substances. Patent dated January 18th, 1849; six months.

Thomas Newcomb, of Bermondsey, machinist, for improvements in furnaces. Patent dated January 18th, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. Stewart, of Middlesex, pianoforte-maker, for improvements in the mechanism of horizontal, grand, and square pianofortes. Patent dated January 15th, 1835; expired January 15th, 1849.

A. Shanks, jun., flaxspinner, of Arbroath, for certain improvements in machinery for preparing and dressing hemp and other fibrous substances. Patent dated January 15th, 1835; expired January 15th, 1849.

J. Cherry, of Coventry, painter, for certain improvements in bedsteads, or apparatus applicable for the ease and comfort of invalids and others. Patent dated January 15th, 1835; expired January 15th, 1849.

W. Houston, of London, printer, for certain improvements in typefounding. Patent dated January 15th, 1835; expired January 15th, 1849.

Sir John Franklin's Expedition.—We regret to announce, by accounts from Mazatlan, under date Nov. 29, that her Majesty's surveying-ship Herald, 22, Captain Kellett, had arrived at that port from Behring's Straits, without having been able to obtain any intelligence of the expedition under Sir John Franklin.

The California Gold Mines.—Letters from California state that further discoveries had been made in the gold region, which yield even a more abundant supply than the previous diggings. According to the latest accounts the gathering amounted on the average to about 100,000 dollars daily, and was constantly increasing, without apparently an exhaustion or any limit to the supply. There was a great amount of distress among the diggers from the want of the common necessaries of life, and attended with very extensive sickness and mortality. Men loaded with gold appeared like haggard vagabonds, clothed in filthy garments of the meanest kind. To show the value at which liquors are estimated it is stated that one man who had two barrels of brandy sold them at the mines by the small wineglass at rates which realized him 14,000 dollars in gold. Everything, and particularly articles of food and raiment, were at most unheard-of prices; for gold was so plentiful in the possession of every one that it seemed to have lost its value. Daily additions are being made to the numbers employed in digging. No portion of the vast flood of emigration from the United States had arrived. A party of Mormons had collected large quantities of gold in the neighbourhood of the Salt Lake; while on a journey one of them lost a mule with 1,280 dollars' worth of gold on its back. The animal being frightened ran off in the midst of a vast plain, and was irretrievably lost. A person lately returned from the "diggings" states that cattle were plentiful in the country, vegetables generally scarce, and very little fruit. There was a considerable quantity of flour at Sutter's Fort, and large quantities were pouring in. He also says that he has read no account that at all exaggerates either the quantity or quality of the gold. He further states that gold is found in dry ravines as well as those covered with water. Persons who collect with any kind of system amass three times the quantity of dust and ore as those who go digging anywhere do. A party of some twenty or thirty were exploring a dry ravine that led to a mountain supposed to be rich with the precious ore; when near its base they came suddenly upon a spot which glittered with gold-dust and ore, caused by the washings from the mountains. In an instant every man threw himself upon the ground where lay scattered the treasure, and, sprawling out his arms and legs, claimed a right to that portion of the earth. The title was regarded by each as good, and the average yield in a short time was upwards of 300 dollars. Accounts received from Mazatlan inform us that vessels had arrived there from California with gold, some of which had been assayed, and found to average twenty-one carats. Her Majesty's surveying-brig Pandora, 6, Lieutenant James Wood, commander, had taken 280,000 dollars' worth in all, and was to land it at Panama, to be sent across the Isthmus to Chagres, and by the mail-steamers to Southampton. It is stated in the New York papers that the Government had recently received very late advices from the gold region of such a glowing and glittering character as even to justify the withholding of particulars from the public. The New York shipping lists exhibit a large number of vessels up for California, and numbers were sailing daily full of passengers and goods. Messrs. Howland and Apenwall, of New York, are having a vessel constructed in three sections, so as to be transported on shipboard to California.

New Great Seal of Ireland.—It is not often we have occasion to congratulate that portion of the Irish Executive entrusted with the issue of patents, or its businesslike habits, or Irishmen in general, with taking the lead in any matter of practical improvement. In the present instance, however, we have to award to the Dublin officials the merit of being the first to avail themselves of that very valuable accession to our store of useful substances, gutta percha. Most people who have had anything to do with patents are aware that the impression of the Irish great seal has hitherto been made in a sort of wax, offensive both to the smell and touch, and of so brittle a nature as scarcely to bear carriage, and, above all, "used to the melting mood." Instead of this, gutta percha is now used, and with manifest advantage. The gutta percha seal possesses a boldness and sharpness of outline which we have seldom seen equalled even in the choicest medals. We hope to see it soon adopted also for the English and Scottish seals.—*Mechanics' Magazine.*

TO CORRESPONDENTS.

"A Subscriber" thus addresses us:—"Would you be kind enough to inform me, and perhaps others of your readers, the reason or cause of Liebig's designation of Mulder as the 'Iatro Chemist'?"—The term is intended, we believe, to be one of reproach; but the reproach is harmless, except to Liebig himself, who greatly damages his fame by using this and similar appellations.

"W. H. Potter" writes us the following letter, which, if none of our correspondents answer, we will do so ourselves in the forthcoming number:—"Sir,—As a consistent reader of your esteemed periodical, and a subscriber from the beginning, I request you (or some of your chemical correspondents) to inform me of the best and most compendious and expeditious mode of analyzing a liquid containing lime, alumina, magnesia, peroxide of iron, and phosphoric acid, all in solution in muriatic acid. Correctness in the process is indispensable."

"An Agricultural Chemist."—1. The hardness of water may be overcome, and the water rendered adapted for most culinary purposes, by the addition of a little carbonate of soda. If the hardness be dependent on the bicarbonate of lime, it may in general be obviated by putting into the water-tank a lump of quicklime, which reduces the soluble bicarbonate to the insoluble monocarbonate. 2. We do not know the particulars relative to the essay. Address a letter on the subject to some publisher in London, who will ascertain for you the necessary particulars. 3. What size is the chamber to be? As a rough guess we should say one containing 10,000 would cost £100. Acid of sufficient strength may be used, indeed is obtained without the trouble and expense of distillation; should you develop your manufacture and desire a superintendent, we can, perhaps, aid you in finding one.

"Mr. N. Matthews.—The carron oil is a liniment for burns, much used at the Carron Iron Works, and is made by mixing and agitating together equal parts of linseed-oil and lime-water.

"Mr. James Paterson."—Orfila's hair-dye is a plumbate of lime, made by boiling for an hour and a quarter 4 parts of sulphate of lead with 5 parts of slaked lime and 30 parts of water, filtering the liquor, and collecting the powder. This in a warm solution will dye the hair a fine black in one hour.

"Mr. Stephen Bowden." — Marshmallow paste, considered to be an expectorant, is thus made:—Take 4 ounces of the fresh roots of marshmallow; infuse for twelve hours in 5 pints of water; strain, and add 2 pounds each of gum arabic and refined sugar; dissolve by means of a gentle fire, strain through linen by pressure, evaporate over the fire to a consistence of a soft extract; then form it carefully into a mass, and to every 5 pounds add 12 whites of eggs, beat up and mixed with 4 ounces of orange-flower-water. Agitate the mass, and expose to heat to thicken it; then spread it out on a table covered with starch.

"Mr. James Ross."—Genuine potassa fusa, or hydrate of potash, should contain more than two parts of potash to one of carbonic acid. It usually contains many earthy and saline impurities, and often iron and manganese to the amount of about 3 per cent. Lime may be detected by precipitating it from solution by a solution of sesquicarbonate of soda. None of these impurities are of much consequence in a medicinal point of view. It is soluble in twice its weight of water, and what remains undissolved is earthy and other impurities. It is insoluble in alcohol, but combines, like an alkali, with oils in the form of soap.

"Mr. James Bryant."—Perfumery camphor balls are thus made:—Grind in a starch-mill 6lb. of very dry starch, 8lb. of very dry white lead; sift it through a lawn sieve, and then mix it with 14lb. of very fine rice powder; shave down and dry 48lb. of the best oil soap, and mix with the former. Next grind 1½lb. of camphor in an iron mortar, with ½ pint of Hungary water, and add gradually ½ ounce each of oil of rosemary and of lavender. When reduced to powder add a few pounds of the prepared soap, and, after beating it well, mix the whole together, and make it in the same way as ambergris washballs. It is a cosmetic, but not to be considered safe.

"A Subscriber."—The wrapper forwarded to us is not liable to the stamp duty.

"Mr. W. Bowden, Manchester," will find the desired information on the electric light in the specification of Mr. Staite's patent, which we print in this week's number.

"P. O."—Use alcohol of about 80 C. for the first operation, absolute alcohol for the second. Distil off two thirds of the alcohol. The addition of essence of lemon to the product is, to say the least of it, perfectly useless.

"R. M., Chelsea."—The oil of bitter almonds is one of the most virulent vegetable poisons. It should never be used for flavouring cakes.

"Mr. T. C. Romer, Liverpool."—It does not necessarily follow that a person bitten by a mad dog *must* die of hydrophobia. Nay, the majority of those who have been bitten would seem to escape that dreadful affection. Notwithstanding this, however, excision of the bitten part and cauterization should never, under any circumstances, be neglected. There are instances on record, also, that the bite of dogs in a state of venereal excitement has caused hydrophobia.

"S. R."—The subject shall receive due consideration.

"Mr. William Seymour, 40, Blossom-street, Manchester." You may prepare purple of cassius most easily by the following process:—Take of crystallized protochloride of tin, 1 part; crystallized perchloride of tin, 2 parts. Dissolve the two chlorides separately, mix the solutions together, and add the mixture to a solution of 1 part of crystallized terchloride of gold. Wash and dry the precipitate. Or, take of silver 150 parts, gold 20 parts, tin 35.1 parts; fuse these three metals together under charcoal and borax; cool, laminate, and dissolve out the silver by means of nitric acid. This preparation is used as a purple in porcelain painting, and to communicate a ruby-red colour to glass when melted in *open* vessels. To the second question: We are not aware of the existence of a work of that kind.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—January 27, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

LECTURE VI.

I concluded the last lecture with the characteristic reactions of aniline, and dwelt more especially upon its comportment with strong nitric acid. The action of nitric acid upon organic substances produces changes in their composition in two ways. There is sometimes merely an assumption of oxygen to the elements of the organic body, the acid being reduced to the state of nitric oxide, and passing off. *E.g.*, indigo with nitric acid yields isatine, which is the former, plus two equivalents of oxygen :—

$$\underbrace{C_{16}\ H_5\ NO_2}_{\text{Indigo.}} + NO_5 = \underbrace{C_{16}\ H_5\ NO_4}_{\text{Isatine.}} + NO_2$$

Cinnamic acid, treated with nitric acid, gives hydride of benzile; water being formed and carbonic acid :—

$$\underbrace{C_{18}\ H_8\ O_4}_{\text{Cinnamic acid.}} + 4NO_5 = \underbrace{C_{14}\ H_6\ O_2}_{\text{Hydride of benzile.}} + 2Aq + 2NO_2 + 2NO_4$$

By a further supply of oxygen the hydride of benzile is converted into benzoic acid :—

$$\underbrace{C_{14}\ H_6\ O_2}_{\text{Hydride of benzile.}} + NO_5 = \underbrace{C_{14}\ H_6\ O_3}_{\text{Benzoic acid.}} + NO_4$$

More complex decompositions, however, occur in other cases ; nitric acid not only supplying oxygen, but also nitrogen, to the newly-sought compound. When indigo is subjected for a very long time to the action of fuming nitric acid, a series of interesting changes occur, nitrophenisic acid, carbazotic acid, being the ultimate product, which contains a much larger proportion of nitrogen than the indigo :—

Indigo .. .. $C_{16}\ H_5\ N\ O_2$
Carbazotic acid .... $C_{12}\ H_3\ N_3\ O_{14}$

I have noticed the preceding for the purpose of introducing to you the action of nitric acid upon nitrobenzol, the substance whence aniline is derived. A few years back the replacement of hydrogen by peroxide of nitrogen, NO_4, had been limited to acids and neutral bodies, when Dr. Hofmann and myself, in the laboratory of Liebig, deemed it a point of great interest to ascertain whether peroxide of nitrogen, NO_4, could also replace hydrogen in basic compounds without altering their electro-positive nature. We endeavoured to accomplish our purpose by the direct action of nitric acid on aniline, but did not succeed. Dinitrobenzol occurred to us after a series of unsuccessful experiments.

The transformation of nitrobenzol into dinitrobenzol proceeds very slowly, even after repeated ebullitions with the strongest nitric acid. It is obtained, however, very rapidly by dropping benzol or nitrobenzol into a mixture composed of equal parts of fuming nitric acid and concentrated sulphuric acid, as long as the menstruum remains homogeneous. If the liquid be boiled, and then allowed to cool, the whole solidifies. The crystals edulcorated with water, and recrystallized from alcohol, afford the binitrobenzol in a state of purity. Sulphuric acid is added to withdraw water from the nitric acid, thereby making its action more energetic :—

$$C_{12}\ H_5\ NO_4 + NO_5 = C_{12}\ H_4\ 2NO_4 + HO$$

or

$$\underbrace{C_{12}\left\{\begin{matrix}H_5\\NO_4\end{matrix}\right\}}_{\text{Nitrobenzol.}} + NO_5 = \underbrace{C_{12}\left\{\begin{matrix}H_4\\2NO_4\end{matrix}\right\}}_{\text{Binitrobenzol.}} + HO.$$

When an alcoholic solution of dinitrobenzol is saturated with ammoniacal gas and hydrosulphuric acid repeatedly, and after each saturation the menstruum boiled, a quantity of crystals of sulphur deposit. Hydrochloric acid is then added, and the whole filtered. Potassa gives a brown resinous mass with the filtrate, which, when washed with cold water, to remove all the alkali, and dissolved in hot water, affords nitraniline :—

$$C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N$$

the first base discovered containing the elements of peroxide of nitrogen. The metamorphosis of dinitrobenzol under the influence of reducing agents is perfectly analogous to the transformation of nitrobenzol. In fact, the decomposition is exceedingly simple, if we regard dinitrobenzol as nitrobenzol in which one equivalent of hydrogen is replaced by peroxide of nitrogen :—

$$C_{12}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}NO_4 + 6HS = C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N + 4Aq + CS.$$

This base is slightly soluble in cold, easily in hot, water. Alcohol and ether also dissolve it. Nitraniline is soluble in all acids. It is a very weak base, aniline displacing it from all its compounds. The formula of a few of its salts are appended whose constitution resembles the corresponding salts of aniline :—

Hydrochlorate of nitraniline ..... $C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N + H.Cl.$

Binoxalate of nitraniline..... $C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N2(HO, C_2\ O_3) + Aq.$

Platinum salt ..... $C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N, HCl, PtCl_2.$

Nitraniline is not further decomposed by reducing agents. If an alcoholic solution be treated with gaseous ammonia and sulphide of hydrogen no further change occurs.

You have heard that chlorine, bromine, and peroxide of nitrogen can replace hydrogen in organic alkaloids without altering their basic properties.

Hofmann lately studied the action of iodine upon aniline for the purpose of completing the series.* The action of chlorine and bromine on aniline is most powerful; so great is it that those products of substitution only can be obtained possessing no basic properties, because the whole of the hydrogen has been displaced. The basic anilines in which a few equivalents of hydrogen are substituted have, nevertheless, been produced by the action of alkalis on chlorinated and brominated isatine. Adopting a similar method would not serve for forming the iodinated aniline, there being no iodisatine. The iodine base was produced by acting directly upon aniline with iodine.

* Chemical Society's Transactions, Oct. 1, 1848, page 269, et seq.

By the discovery of nitraniline and iodaniline the aniline group of compounds is greatly enhanced.

A synopsis of some of the members of the family will show you the law of substitution beautifully displayed with regard to aniline and its derivatives :—

Aniline ..... $C_{12}\ H_7\ N$
Chloraniline ..... $C_{12}\left\{\begin{matrix}H_6\\Cl\end{matrix}\right\}N$
Dichloraniline .... $C_{12}\left\{\begin{matrix}H_5\\Cl_2\end{matrix}\right\}N$
Trichloraniline .... $C_{12}\left\{\begin{matrix}H_4\\Cl_3\end{matrix}\right\}N$
Chlordibromaniline $C_{12}\left\{\begin{matrix}H_4\\Cl\\Br_2\end{matrix}\right\}N$
Nitraniline ..... $C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N$
Nitrodibromaniline $C_{12}\left\{\begin{matrix}H_4\\Br_2\\NO_4\end{matrix}\right\}N$
Iodaniline ..... $C_{12}\left\{\begin{matrix}H_6\\I\end{matrix}\right\}N$

From the above you perceive that the hydrogen of aniline may be partially displaced by chlorine, iodine, bromine, and peroxide of nitrogen, without the basic character of the type being destroyed.

We will now discuss more fully indigo, isatine, &c., as they have been so repeatedly mentioned. Indigo is a blue colouring matter extracted from the Indigofera tinctoria. Berzelius found it to consist of gluten, a brown extract, a red matter, and indigo-blue. The gluten is soluble in water and alcohol. Berzelius obtained it by digesting indigo in dilute sulphuric acid, neutralizing by carbonate of lime, filtering, evaporating, and heating the desiccated residue in alcohol. The brown matter was extracted by potassa from the above minus the gluten, and thrown down by sulphuric acid. After the preceding separations the remaining indigo was treated with alcohol, which dissolved a red substance insoluble in water and potassa, but dissolved by concentrated sulphuric acid. The substance remaining is indigo, which affords in the heat a magnificent purple vapour, like iodine, but without its irritating smell. Fritzsche's process is excellent for obtaining pure indigo from the substance sold in commerce. Four ounces powdered indigo of commerce and about the same quantity of grape-sugar or honey are mixed with a little alcohol, and placed in a bottle capable of holding ten pounds; to which are added six ounces of strong caustic soda, the bottle filled up with hot alcohol, well stopped, agitated, and then set aside. In some hours the clear red liquor must be syphoned from the deposit into another vessel, and left for some days partially excluded from the air, when the indigo-blue will precipitate. On treating with alcohol and affusing with water it is obtained perfectly pure.

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLIII.

(LECTURE LXXI.)

EXTRACTIVE.

SECTION II.—PURGATIVE EXTRACTIVE—(*Continued*).

ELDER BARK.

The inner bark of the root of the elder (Sambucus nigra) is used in medicine as an emeto-cathartic.

JUICE OF THE BARK OF THE ELDER.

Select roots of half an inch to one inch in diameter; strip off the outer cellular tissue and the epidermis ; pound the fleshy part in a mortar ; strain and filter.

The juice of elder bark has a reddish-brown colour, a sweetish taste, and a faint, slightly nauseous odour.

Patients take this juice without repugnance. It is given in doses of thirty to sixty grammes.

The bark of Sambucus ebulus is used for the same purposes as that of the elder, but more rarely than the latter.

BLACK ELLEBORE.

The root of the black ellebore (Helleborus niger) has been analyzed by Feneulle and Capron, who found in it :—

Volatile oil,
Fatty oil,
Volatile acid,
Resinous matter,
Wax,
A bitter principle,
Mucus,
Ulmin,
Gallate of potass,
Acid gallate of lime,
Ammoniacal salt.

And also by Vauquelin, who found it to contain:—

An acrid and caustic oil,
Starch,
A vegeto-animal substance,
Traces of sugar,
Extractive matter.

According to Feneulle and Capron the active principle of ellebore is constituted by a species of chemical association between the volatile acid and the fatty oil.

Vauquelin, on the other hand, attributes the medicinal action of the root of the ellebore to the acrid oil, which, according to his analysis, forms one of the principal constituents of the root; but this acrid and caustic oil of Vauquelin seems to be the same substance as Feneulle and Capron's mixture of volatile acid and fatty oil.

Vauquelin saw the acrid oil deposit a white crystalline matter, which he neglected, however, to examine.

Both analyses are very imperfect.

Ellebore is used as a drastic purgative: it seems to exercise a special action on the brain. It is rather a dangerous agent, and should be used with great caution only.

M. Orfila has ascertained that the root of the black ellebore loses part of its properties by desiccation, and that its medicinal efficacy diminishes with keeping. This may be readily accounted for if we take it for granted that the medicinal action of the ellebore is to be attributed to the presence of a volatile principle among its constituents. And, on the other hand, the preservation of part of this volatile principle in the dried root might be readily explained by the close association which would appear to exist between this principle and the fatty matter.

POWDER OF ELLEBORE.

Reduce the root to powder without leaving any residue.

The powder of ellebore being still more liable to alteration and loss of its medicinal properties than the root in its original state, a small quantity only should be prepared at a time, and kept in tight-stoppered bottles.

POMATUM OF ELLEBORE.

Take of Powder of black ellebore, 1 to 2 parts.
Hogslard, 8 parts.

Mix.

This pomatum is used in cases of impetigo of old standing.

AQUEOUS SOLUTION OF ELLEBORE.

This form is now almost entirely abandoned; it was at one time rather extensively used as a purgative.

The decoction of black ellebore has been successfully employed in cases of tinea and itch.

Cullen gives the following formula:—

Take of Decoction of ellebore, 500 grammes.
Sulphuret of potassium, 2 grammes.

Mix.

There appears, however, just as much reason to ascribe the favourable action of this compound to the alkaline sulphuret as to the decoction of the ellebore.

TINCTURE OF ELLEBORE.

Take of Black ellebore, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Let the mixture macerate for eight days; strain with expression, and filter.

M. Personne uses alcohol of 56 C. instead of that of 80 C.

Wendt's tincture of ellebore (recommended in mania) is prepared of one part of the green root of ellebore and eight parts of alcohol of 88 C.

ELLEBORE WINE.

Take of The dry root of black ellebore, 1 part.
Spanish wine, 8 parts.

Comminute the root, pour the wine over it, and let the mixture macerate for eight days; strain with expression, and filter.

ELLEBORE VINEGAR.

Take of The dried root of black ellebore, 1 part.
Vinegar, 12 parts.

Let the root macerate in the vinegar for eight days; strain with expression, and filter.

EXTRACT OF ELLEBORE.

Two sorts of extract of ellebore were formerly used, viz., the aqueous extract and the alcoholic extract (prepared with alcohol of 56 C.). The former is now, however, universally abandoned. With alcohol of 56 C. the root yields a larger proportion of extract than with alcohol of 80 C.

BACHER'S TONIC PILLS.

(Formula of the French Codex.)

Take of Root of black ellebore, 4 parts.
Carbonate of potass, 1 part.
Alcohol of 56 C. (21° Cartier), 16 parts.
White wine, 16 parts.

Put the root, the carbonate of potass, and the alcohol, into a matras, and let the mixture digest for twelve hours at a gentle heat; strain with expression.

Take the grounds, and let them macerate for twelve hours in the wine; boil the mixture, and strain with expression.

Clarify the two liquids by rest or filtration; mix them, and evaporate to the consistence of an extract.

Take of This extract, 2 parts.
Extract of myrrh, 2 parts.
Powder of Centaurea benedicta, 1 part.

Form into a pilular mass, and divide into pills of 5 centigrammes each; silver them over, and keep in an appropriate well-closed vessel.

This formula differs but little from the original formula given by Bacher. The difference lies altogether in the relative proportion of the wine: Bacher prescribes 6 parts of wine to 1 part of the root, whereas the Codex prescribes only 4 parts. Yet this deviation, trifling though it may appear, creates a rather marked difference in the nature of the product. The larger quantity of the fixed principles of the wine which enter into the composition of the extract adds to the weight of the latter, and diminishes in a corresponding proportion the relative amount of the active principles supplied by the ellebore.

I have made several comparative experiments with a view to ascertain the amount of the active principles of the ellebore respectively contained in Bacher's extract and in that of the Codex. I found that 1 part of the latter represents 1.89 of the root, whereas 1 part of the extract prepared according to Bacher's formula (revised by MM. Henry and Guibourt) represents only 1.44 of the root. Accordingly, the physician who prescribes 5 centigrammes of the extract of the Codex gives near upon the matter of 10 centigrammes of the root, whilst he gives only the equivalent of 6 centigrammes of the latter, if his prescription is made up according to Bacher's (or Henry and Guibourt's) formula.

The action of the carbonate of potass upon the root is attended with the emission of an ammoniacal odour, owing to the ensuing mutual decomposition of the potass salt, and of the ammoniacal salt which the root contains.

The intermixture of the vinous liquids with the alcoholic tincture is attended with effervescence; this phenomenon is caused by the decomposition of the carbonate of potass by the acids of the wine; these latter are, however, far from sufficient to separate the potass. Thus a portion only of the carbonic acid is expelled, whilst another portion combines with part of the remaining carbonate to sesquicarbonate of potass.

Bacher's tonic pills contain, accordingly, carbonate, sesquicarbonate, tartrate, and acetate of potass. The presence of the acetate and carbonate renders the pills deliquescent.

These pills are given as a purgative in dropsy, mania, and mental depression, in doses of from 10 to 60 centigrammes.

OXYMEL OF ELLEBORE.

Take of Vinegar of black ellebore, 50 parts.
White honey, 100 parts.

Reduce the vinegar to 29 parts by evaporation in the water-bath; add the honey, and form a mellite by simple solution. Clarify by Desmaret's method.

RHUBARB.

The rhubarb of commerce seems to be the root of the Rheum australe of Tartary. It possesses tonic and purgative properties; in small doses it is given as a tonic, in large doses it acts as a purgative. In the latter quality it agrees more particularly with persons of delicate constitution.

According to Hornemann's analysis, rhubarb has the following composition:—

	China Rhubarb.	English Rhubarb.	Rheum rhaponticum, or Turkey Rhubarb.
Bitter principle	16.042	24.475	10.156
Yellow colouring matter	9.582	9.166	2.187
Extract with tannin	14.687	16.854	10.416
Apothema of tannin	1.458	1.249	0.833
Matter extracted by potass	28.333	30.416	40.290
Oxalic acid	1.042	0.833	—
Fibre	13.583	15.416	8.542
Moisture	3.333	3.125	6.043
Rhaponticin	..	..	1.043
Starch	..	..	14.583
Loss	0.939	0.629	1.477

According to Brandes, rhubarb contains four per cent. of starch, and the same amount of pectic acid.

The substance called "bitter principle of rhubarb" in the preceding analytical table used to be designated formerly by the name of Caphopicrite. Pfeff calls it Rhabarbarin (Rhubarbarin).

Rhubarbarin has a brown colour, and a bitter, acrid, and disagreeable taste. It is soluble in water, in alcohol, and in ether. It is obtained from the root by the following process:—

Treat the root with water, evaporate the solution obtained to dryness, redissolve in water, filter the solution, and evaporate again to dryness. Redissolve the residue in alcohol, and evaporate once more.

MM. Caventou and Peretti regard Rhubarbarin as a compound of the colouring matter, and of a brown substance, insoluble in water, soluble in alcohol, which Peretti designates as resin, and which, according to Dr. Tagliabo, acts as a powerful purgative in doses of ten to twelve grains.

As already stated, Rhubarbarin is soluble in water, although the two matters which, according to Caventou and Peretti, constitute it dissolve separately in that menstruum only sparingly and with difficulty.

The colouring matter of rhubarb (Rheïn, or Rhubarbaric acid) is a crystallizable, yellow substance. Exposed to the action of fire, it volatilizes partly in yellow, odorous vapours; it has a bitter, harsh taste. It is sparingly soluble in cold, but more readily in hot, water. In alcohol of 75 C. it dissolves very sparingly, even though the alcohol be boiling; it is more readily soluble in absolute alcohol.

It dissolves in alkalis; the alkaline solutions have a fine red colour. Acids precipitate it from these alkaline solutions. The compounds which rheïn forms with metallic oxides are insoluble in water; those which it forms with the acids are yellow. Gelatine throws it down from its solutions in form of a tough precipitate. Nitric acid acts upon it with great difficulty only.

Rheïn is obtained best by the following process (Henry's):—

Take 85 parts of the aqueous extract of rhubarb, and 22½ parts of nitric acid of 1.325, diluted with 255 parts of water. Mix, and heat the mixture slightly, when the extract of rhubarb will separate into two parts; the one of which, the orange-coloured one, is the colouring matter. Purify the latter by repeated washing with water.

It may be obtained also by heating powder of rhubarb in a crucible covered with a funnel. A portion of it may be extracted also by the

direct action of ether upon powder of rhubarb.

It must be confessed that the nature and properties of the bitter principle of rhubarb and of rheïn are as yet but imperfectly known to us.

Professor Dulck believes that the active matter of rhubarb is a deliquescent substance, readily soluble in water, in alcohol, and in ether. He calls this substance rheïn, and assumes the principle usually so called to be a product of decomposition. Dulck's rheïn has the odour and flavour of the root.

It would appear that rhubarb, besides the elements which we have already enumerated, contains also a little volatile oil, which gives to the root its peculiar odour, and, according to Peretti, some sugar. It appears to contain, moreover, a little fixed oil, soluble in alcohol and in ether.

China rhubarb contains, according to Henry, one third of its own weight of oxalate of lime; Muscovy rhubarb contains a little less, French rhubarb only about ten per cent. of that salt.

The rhaponticin which Hornemann found in Rheum rhaponticum crystallizes in yellow spangles. It is insipid and inodorous. It refuses to dissolve in cold water. It is insoluble also in ether and in the volatile oils.

I. PREPARATIONS CONTAINING THE WHOLE SUBSTANCE OF THE RHUBARB.

POWDER OF RHUBARB.

Reduce the root to powder without leaving any residue.

The powder of rhubarb has a fine yellow colour. It is given in doses of forty to sixty centigrammes, as a tonic, stomachic, and digestive. In doses of two to four grammes it acts as a purgative.

LOZENGES OF RHUBARB.

Take of Rhubarb in powder, 1 part.
White sugar, 11 parts.
Mucilage of gum tragacanth, made with cinnamon-water, a sufficiency.

Make into lozenges of sixty centigrammes each.

II. PRODUCTS OBTAINED BY THE ACTION OF WATER UPON RHUBARB.

AQUEOUS SOLUTION OF RHUBARB.

The liquids obtained by macerating rhubarb in cold, or infusing it in boiling, water are transparent. The liquid obtained by decoction is turbid, or turns so upon cooling.

If either of these liquids is evaporated to the consistence of an extract, and the latter is then redissolved in water, there remains an undissolved residue behind, of resinous appearance; this residue dissolves readily in alcohol. M. Henry called it resin of rhubarb. It is brown, and possesses in a considerable degree the smell and taste of rhubarb; decoction in water effects partial solution of it, and this solution turns turbid upon cooling; the filtrate of the turbid solution looks exactly like the simple infusion of rhubarb. Repeated decoctions in water are attended with the same result, with this difference only, that the relative proportion of matter dissolved decreases with every new process of decoction. According to Henry, this is to be attributed to the circumstance that the treatment of the extract with water fails to effect the total separation of the resinous substance from the soluble principles of the rhubarb.

Thus, when rhubarb is treated by maceration or infusion, part of the resinous matter dissolves in the water (owing to the presence and influence of the other principles contained in the root). Subsequently, upon the concentration of the liquid, part of this resinous matter separates in conjunction with a portion of the soluble principles, which latter may then, as we have seen, be removed by repeated decoctions in water. Rhubarb-root which has been subjected to the action of cold water simply retains a portion of the same resinous compound, which may be extracted from it by the action of alcohol.

The decoction of the root carries off a larger proportion of the resin than either maceration or infusion. It is the suspended resin that imparts the turbid appearance to the decoction of rhubarb.

When the rhubarb is intended to act as a tonic, the aqueous solution of one to one and a half gramme of the root will suffice for a dose; but, when it is intended to act as a purgative, from eight to twelve grammes of the root will be required.

Some practitioners add carbonate of potass to the aqueous solution of rhubarb. The addition of this alkaline carbonate imparts to the liquid a red-brown tint, from the action of the alkali upon the colouring matters of the rhubarb. Some add the carbonate simply to the aqueous solution, in which case no other effect is produced than that the medicinal action of the carbonate is combined with that of the rhubarb. Others boil the rhubarb in a solution of the alkaline carbonate, which proceeding has the effect to determine the solution of that portion of the resin which simple treatment with water would have left behind in the root.

EXTRACT OF RHUBARB.

Take of Rhubarb, 1 part.
Water of 68° F., 7 parts.

Tear the root into small pieces with a pair of pincers, throw the pieces into four parts of the water, and keep macerating for twelve hours; strain with slight expression; macerate the grounds for twelve hours in the remaining three parts of the water. Strain with expression. Pour the two products together, filter, and evaporate the filtrate to the consistence of an extract.

China rhubarb yields about one half its own weight of extract.

SYRUP OF RHUBARB.

Take of Rhubarb, 1 part.
Water, 5 parts.
Sugar, a sufficiency.

Let the rhubarb macerate in the water for twelve hours, strain with expression, and filter. Add to the filtrate 180 parts of sugar for every 100 parts of liquid, and prepare a syrup by simple solution in the water-bath. Thirty grammes of the syrup contain the soluble parts of two grammes of the root.

III. PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON RHUBARB.

TINCTURE OF RHUBARB.

Take of Rhubarb, 1 part.
Alcohol of 56 C., 5 parts.

Let the rhubarb macerate in the alcohol for fifteen days; strain with expression; filter.

Alcohol dissolves the whole of the active principles of the rhubarb. The alcoholic tincture contains, of course, a proportionally larger amount of the resinous principle than the liquids obtained by the action of water upon the root.

One part of the tincture represents a trifle less than the one fifth of its own weight of rhubarb.

ALCOHOLIC EXTRACT OF RHUBARB.

Take of Rhubarb, 1 part.
Alcohol of 56 C., a sufficiency.

Treat the rhubarb repeatedly with alcohol; distil the products, and evaporate the residue to the consistence of an extract.

Rhubarb treated with alcohol yields about the same quantity of extract that is obtained by the action of water; but the alcoholic extract contains, of course, a larger proportion of resin than the aqueous extract.

IV. PRODUCTS OBTAINED BY THE ACTION OF WINE UPON RHUBARB.

RHUBARB WINE.

Take of Rhubarb, 8 parts.
Cinnamon, 1 part.
Malaga wine, 250 parts.

Let the rhubarb and cinnamon macerate in the wine for eight days; strain with expression; filter.

DAREL'S TINCTURE.

Take of Rhubarb, 8 parts.
Bitter orange-peel, 2 parts.
Lesser cardamoms, 1 part.
Elicampane-root, 4 parts.
Madeira wine, 125 parts.

RUMEX PATIENTIA.

The root of Rumex patientia is used as a diuretic and depurative. It enjoys considerable reputation in the treatment of diseases of the skin.

According to Riegel, the root of Rumex patientia contains:—

Resin,
Rumicin,
Sulphur,
Extractive matter resembling tannin,
Starch,
Albumen,
Divers salts.

Rumicin bears the strongest resemblance to rhubarbarin; the two principles seem, in fact, to be identical.

The root of Rumex patientia resembles greatly that of rhubarb; like the latter it is astringent, and in large doses acts as a gentle purgative.

The aqueous extract of patientia redissolves almost completely in water, whilst the alcoholic extract, like that of rhubarb, leaves a very copious residue, possessing in a considerable degree the smell and taste of the root.

PTISAN OF RUMEX PATIENTIA.

Take of Pounded root of patientia, 32 grammes.
Boiling water, 1,000 grammes.

Let the root infuse in the water for two hours; strain.

EXTRACT OF PATIENTIA.

Take of Root of patientia, any quantity you like.
Water of 68° F., a sufficiency.

Moisten the root with one half its own weight of water of 68° F., and proceed by lixiviation.

Evaporate to the consistence of an extract.

The root yields about the one fourth part of its own weight of extract.

An excellent extract may be prepared also by solution of the alcoholic extract of the root in cold water, filtration of the solution, and evaporation of the filtrate.

PULP OF RUMEX PATIENTIA.

Take of Fresh root of patientia, any quantity you like.

Reduce to a pulp by means of the grater.

This pulp is recommended against the itch; it is applied in embrocation and friction.

ANTIPSORIC POMATUM.

Take of Flowers of sulphur, 1 part.
Pulp of patientia-root,
Lemon juice, of each 8 parts.
Hogslard, 16 parts.

M.S.A.

WHITE AGARIC.

White agaric (Boletus laricis) is composed, according to Braconnot's analysis, of—

A peculiar resin..	72	per cent.
Bitter extractive..	2	"
Fungin.....	26	"
	100	

The resin of agaric is white, opaque, granular, and almost tasteless. Cold water exercises but little action upon it. By boiling it in water, a thick, viscous, ropy, and frothy liquid is produced. It is soluble in hot ether, and in essence of turpentine; it combines with the alkalis. Nitric acid exercises hardly any action upon it. It reddens litmus paper.

Agaric is a drastic purgative. It is given also against nocturnal perspiration in doses of twenty centigrammes, to be taken in the evening (one dose) in a mucilage or some bitter extract.

POWDER OF AGARIC.

Cut the agaric into thin slices, dry in the stove, and reduce to powder in a covered mortar.

EXTRACT OF AGARIC.

Take of Agaric, 1 part.
Cold water, 6 parts.

Macerate the agaric in four parts of the water; strain with expression; macerate the grounds in the remaining two parts of water, strain, pour

the liquids together, and evaporate to the consistence of an extract.

COLOCYNTH.

Colocynth (Cucumis colocynthis) is used as a drastic purgative (in doses of fifty centigrammes to one gramme). This substance may cause inflammation of the tissues, and should be administered with great caution.

According to Meisner's analysis, colocynth contains :—

A fatty oil,
Bitter resin,
A bitter principle (colocynthin),
Extractive,
Gum,
Pectic acid,
Gummous extract,
Salts.

The bitter principle of the colocynth has been studied by Braconnot and Herberger. Its colour is reddish yellow (the colour of the powder is yellow). It is translucid and friable, and has an exceedingly bitter taste. It burns like a resin. It dissolves in five parts of cold water, but is much more largely soluble in boiling water ; refrigeration fails to effect its separation from the solution in the latter menstruum. It is equally soluble in alcohol and in ether. Acids and highly deliquescent salts precipitate it from its solutions in form of a coherent, viscous mass. Alkalis fail to precipitate it. It contains nitrogen, and, according to Braconnot's observation, restores the blue colour of reddened litmus paper. Infusion of gallnuts fails to precipitate it from its solutions.

The bitter principle is associated in the parenchyma of the fruit with other matters which alter its purity. Thus, by treating the fruit with alcohol we obtain a yellowish product, apparently of complex nature. The action of cold water separates this product into two parts, of which the one dissolves in the water, and the other is deposited in form of white threads. These latter unite subsequently into a yellowish, ductile mass resembling soft resin. Repeated treatment with fresh quantities of water succeeds in the end to effect the solution of this matter. Upon evaporation the dissolved matter separates again in form of a yellow resin ; however, if the evaporation is carried to dryness, the residuary extract presents a brown colour. This extract is exceedingly bitter ; it dissolves in a small proportion of water.

To produce the bitter principle of the colocynth Braconnot dissolves this aqueous extract in alcohol, by which means the gum is separated. He evaporates the solution, and treats the residue with a small quantity of water, which dissolves a little acetate of potass, and leaves nearly the whole of the bitter principle behind. In this state the bitter principle seems to be associated with some foreign matter, which imparts to it the property of being precipitated by infusion of gallnuts, which, as we have stated, fails to precipitate the pure principle.

Herberger prepares, in the first place, an alcoholic extract of colocynths. He dissolves this extract in a copious amount of hot water (not boiling). He filters the solution, and precipitates the filtrate with acetate of lead. He filters again, and then removes the excess of lead by transmitting through the liquid a current of sulphuretted hydrogen gas. He now evaporates to the consistence of a thin syrup, and adds to this ammonia (slightly in excess), which precipitates the bitter principle in form of yellow flakes. He expresses the latter, and redissolves them in alcohol. He clarifies the solution with animal charcoal, and evaporates finally to dryness.

POWDER OF COLOCYNTHS.

Remove the seeds, and dry the fleshy part in a stove. Pound in a mortar, and sift the powder through a hair sieve.

WINE OF COLOCYNTHS.

Take of Incised colocynths, 1 part.
Alcohol of 56 C., 3 parts.
Good white wine, 47 parts.

Let the colocynths macerate in the alcohol for twenty-four hours, add the wine, and continue the maceration eight days longer. Strain with expression, and filter. 30 grammes of the filtrate contain the substance of 60 centigrammes of colocynths.

EXTRACT OF COLOCYNTHS.

Take of The fleshy part of the colocynth, any quantity you like.

Macerate in cold water; strain with expression, and evaporate to the consistence of an extract, taking care to add, towards the termination of the process, a small quantity of alcohol, which serves to distribute the resinous matter more equally through the mass of the extract, and to render the latter uniform.

The extract of colocynths has a yellow-brown colour and an excessively bitter taste. It is inodorous.

Besides the aqueous we use also the alcoholic extract of colocynths.

POMATUM OF COLOCYNTHS.

Take of Powder of colocynths, 1 part.
Hogslard, 3 parts.

Mix.

This pomatum is recommended as a purgative in frictions on the abdomen. The quantity usually rubbed in varies from 2 to 4 grammes.

THE IDEA OF POLARITY.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION, ON FRIDAY EVENING, JAN. 19,

By the Rev. W. WHEWELL, D.D.,
Master of Trinity College, Cambridge.

Gentlemen, I would have felt considerable hesitation in attempting to address such an audience as this on a subject which cannot derive, either from experiments or from apparatus to be exhibited, an interest frequently attaching to lectures delivered in this place ; but, the managers of this institution having thought that a lecture on the idea of polarity may have its interest, I was most willing and desirous to second their views, and now appear here to select and present, in the brief period assigned to me, from the general science of the subject, such conceptions as are of greatest importance. I do not know whether a large portion of the company look with alarm on anything so apparently technical and metaphysical as the exhibition of an idea ; but I have no doubt that, if I can succeed in bringing to the minds of those present the operations in which the idea is involved, I shall facilitate the progress of science, so far as the present audience is concerned. I am aware that there are some who have taken a view of the progress of science different from this,—persons who maintain that there is a metaphysical and a positive state of science, whose cultivation and progress are distinct and independent of each other. I believe that views of that kind proceed on notions altogether opposed to the whole history of science. Whenever the progress of positive science has been most real the metaphysical methods have been most actively employed, and it is the very condition of all progress that this should be so. Time, space, number, force, resistance, limitation, and quantity, considered in a general form, are conceptions as abstract and metaphysical as any it is possible to form ; and the idea of contrariety, in its largest sense, is one which might be called metaphysical very consistently. I am, however, well aware that the notion of polarity is necessary to understand the advances of experimental science now going on amongst us. We cannot comprehend the truths of science in their general form without possessing ourselves of the idea which is the source and result of all the details of science ; and all attempts to do so are abortive. Each class of intelligence in every era has its taste in the scientific field. In the last century those who loved science, and were devoted to her, strove to possess themselves of the ideas concerned in understanding, in their largest and truest sense, the Newtonian system of philosophy. What were momentum, inertia, *vis vivæ*, greatest and least action? These and other abstract terms, more or less familiar, furnished occupation to the philosophic minds of the last century. In the progress of science many of these questions have been elucidated ; and new facts have suggested us many other questions to solve and many additional ideas to investigate. Among the most important of these is the idea of polarity.

In attempting to treat of the idea of polarity I must begin by speaking of poles.

The first instance in which we find poles spoken of with any degree of circumstantiality is in Gilbert's work on the magnet, and in his "Philosophy," published in 1600. Bacon has spoken of this writer with much injustice. He says :—" Gilbert has extracted a philosophy out of the magnet." Yes, it is true Gilbert did so, but he laid the foundations of his reasonings as wide and deep as did Bacon himself. He speaks of the magnet and its poles, and says that mathematicians are accustomed to speak of poles in connection with every revolving sphere ; and he says the magnet has its poles ; there are certain termini which limit the direction of the force. From that property of the magnet he did extract a part of his philosophy, and even now we have not extracted all the philosophy which that fact contains : it is capable of still giving out much more, and perhaps, when the idea of magnetic polarity is fully grasped, our knowledge will be far more exact of many subjects which we have not been accustomed to associate with it in our thoughts. The notion of the magnet as generally received and understood is that of its north and south poles. It is found that if we approach what is called the north pole of a magnetic needle to the south pole of a magnet they mutually attract one another, and that the two north poles of separate magnets reciprocally repel each other, and that the same is true of the two south poles. But Gilbert further notices the magnetism of the earth by which the magnetic needle remains in a certain determinate position at every part of the earth's surface. At most parts this direction was believed to be immediately north and south. He was the first to suggest that this polar tendency of the ferruginous bodies is produced by induction from the magnetism of the earth. The facts of magnetism were at that time too little known to make any very correct theory possible, but, as they became better known, attempts were made to form some simple and general view of the mode in which the needle was influenced, and made to assume its peculiar position. The suppositions which have been hazarded on this point have gone through rapid changes, the history of which is most instructive. Hausteen, a Dane, with amazing industry got together an immense number of observations, and, theorizing on them, he came to the conclusion that there were four magnetic poles to which the needle pointed. One of these he placed in the north of Siberia, one in Spain, one in South Australia, and a fourth in Cape Horn. This view was a great advance upon the previous state of knowledge, but in a short time it was superseded by a larger consideration of the subject by a great German mathematician, who considered the needle as not guided by poles, but all the elements of the earth were regarded as having a magnetic character. He combined and harmonized all the previously known facts, and showed that there are not four magnetic poles, but two only. Gauss afterwards showed that those irregularities which seemed to require the existence of four poles were nothing more than local aberrations ; just as the surface of the earth was here elevated and there depressed, yet not in such a way as to destroy the spherical character, so was the general direction of the lines of magnetic influence modified here and there ; but, notwithstanding, their outline was distinct and regular. This is the first great example of the way in which investigations concerning the property of the magnet to point in a determinate direction were carried out until the

notion of poles disappeared and vanished altogether; so that, instead of poles, we have polarity, the polarity of every element of the earth's surface, and facts at first extremely anomalous became harmonious in the new theory.

Twenty years ago people began to talk of the polarization of light.. This term was long used without any popular explanation of its meaning being given along with it, such a definition as would convey its import to the minds of persons acquainted with only general literature. I heard of a lecturer, a professor of fame in one of our institutions, who, lecturing on minerals, said to his class, about the period of which I am speaking:—"They call it polarization, but it is a word of no meaning. They might as well call it x." But this was a mistake. In point of fact, the term polarization did express a definite idea in a certain manner. Malus, the discoverer of polarization, says he was compelled to employ it on account of the great resemblance of the effect of the forces concerned in its phenomena to that of a needle which turns the poles of a series of magnetic needles all into the same direction. He found that amongst the rays of light there were some which refused to be reflected and transmitted but in a certain direction. A ray of light as it comes from the sun, or any other self-luminous body, provided its angle of incidence and the plane in which it lies are the same, may be transmitted or reflected, and its intensity or direction undergo no alteration. But, if we take a ray that has undergone some reflections, refractions, &c., this uniformity of result disappears. It becomes important, then, in what plane the reflecting or refracting surface presents itself. The ray seems to have got sides to it, and to have a right, a left, a front, and a back, and some of the phenomena of such a ray depend on the position with respect to those sides in which the plane of irradiance lies. The transmissibility or non-transmissibility of such a ray may be rudely represented by comparing the unpolarized ray to a cylindrical rod which in any angle of irradiance to a plane surface may be turned on its own axis, and its relations to the plane yet remain the same, while the relations of a square-sided rod to the plane would vary essentially with every such rotation. Any thin sheet to be thrust through the narrow interstices of a parting must be presented, not crosswise, but in one particular plane. The positions under which alone the ray will pass are related to its sides. To account for this singular property of certain kinds several hypotheses have been published: that most generally received at the present moment is the theory of transverse vibrations discovered by Fresnel. All light is assumed to be propagated by undulatory motion, such as takes place when a long, stretched cord is struck or otherwise disturbed at one end. The wave runs along the cord in the direction of its length, but each molecule of the cord moves in a plane perpendicular to it; and something like this M. Fresnel thinks takes place in the case of light. He imagines that we see only light communicated by such of the vibrating motions of the ethereal molecules as are performed in planes lying perpendicular to the direction of the rays. Thus a polarized ray is one in which the vibration is continually performed in one plane, owing either to a regular motion which the luminous particle has received originally, or to some subsequent cause acting on the waves themselves, which disposes the plane of their direction all one way. An unpolarized ray is, then, one in which the plane of vibration is perpetually changing, or in which the vibrating particles of the luminary are perpetually shifting their planes of motion, and in which no cause has subsequently acted to bring the vibrations thus excited to coincident planes. To grasp the phenomena of transmission and non-transmission, and the other characteristics of certain kinds of light, together, the word polarity indicates the leading circumstance to be attended to.

In electricity the antithesis which we have observed in magnetism and polarized light again comes forward, under the form of attraction and repulsion. For electricity and magnetism the same theory will suffice; at the same time the notion of poles in electricity is not so far advanced as in magnetism, for polarity in the phenomena of the former depends very much on the form of the conductor. It was found necessary, in order to group the facts together as they became known, to conceive some kind of machinery to embrace them, and the machinery conceived at that time was the hypothesis of Coulomb.

At this period the battery and pile of Galvani and Volta were invented, and many collateral researches threw light on that subject. A new kind of polarity was discovered closely connected with chemistry. It was found that the direction of the course of the fluid was determined in some sort by the chemical character of the body employed to produce it. It is true that at an earlier period the latent idea of polarity had slumbered in the distinction according to which every body was regarded as a base or an acid; but when the galvanic battery was discovered the term *poles* came into much more prominent use. Certain chemical decompositions were seen to go on in one place, and produced a current in a place widely removed. You have chemical synthesis and analysis going on. The notion through which these phenomena are envisaged is that certain elements of the decomposed body went in one direction and certain of them in another. The fluid enters at a certain part of the surface of a decomposing body, as at a door. This Dr. Faraday has called the anode: it goes out at another door, as it were, and that he has called the cathode. Here the notion of poles again disappears, and we are left with the idea of polarity. We have no poles, but a tendency determined by the properties of the substance acted on. The connection between the two kinds of polarity, that of magnetism and that of electricity, became far more prominent through the remarkable discovery by Oersted of electro-magnetism—the effects of a galvanic current on a magnet. Oersted for many years studied the connection between the two forces, and he at last found it, and demonstrated its phenomena in a remarkable manner. Any connection between these two forces, it was seen, must be most important; but no one had guessed of what its nature would be. If we connect a copper wire with the two sides of a voltaic arrangement, and stretch it parallel to a magnetic needle, supported on a pivot, and on a plane just above it, the magnet will immediately quit its meridian, and, after a few oscillations, assume a position at right angles with the wire as long as the current continues to pass. This phenomenon led philosophers to look for some fact to explain it. Some believed the wire to be composed of a set of transverse magnets, and some have thought that the magnet was the medium of opposite galvanic currents. What is more clear is that we have two kinds of polarity, axial and current polarity.

It was found also that the two kinds of polarity could be transferred into one another. The galvanic battery was made not only to form magnets, but magnets much more powerful than any which had been known before. This was a great step made, but still the connection was surrounded with difficulty and obscurity. At last a light broke in, and the connection came out in a form so near as to show how true had been the prognostication of its existence, but, at the same time, how difficult it had been to say what would be the manner of its exhibition. If you suppose a magnet to consist of a transverse current you have a positive direction of the current on one hand, and a forward direction on the other; on the one side momentum, on the other reaction. These are all transitory notions, and only likely to be prejudicial if we persist in clinging to them too long. We have arrived at the notion of a current, but what have we really got? Transverse magnetism is galvanism, but what is transverse electricity? To make out this trains of research were undertaken, various experiments were made, and suggestions thrown out, but no definite clear result was arrived at. Men persevered notwithstanding, for it was felt that, if this way of inquiry produced no result, no other method could be prosecuted with any chance of arriving at a solution of the difficulties of the subject. Sometimes we hear the names of men who have attained rank and consideration by the boldness and loftiness of their views. I do not now speak of any one in this country; but there are persons in other countries of great name who have founded systems of philosophy and cosmology in a great degree on the idea of polarity. Schelling and Hegel have constructed two philosophies in which this idea is employed to produce many effects. But they have not stooped to make sure of the facts; they have assumed the general idea, and have divided polarity into positive and negative. Hegel proves *à priori* that light must be polarized, but he proves that just in those cases where it is not polarized at all; and this is the way men who refuse to consult facts, and employ the experimental method, continually do. When we hear of men deriving celebrity from such false and comparatively easy modes of reasoning we should esteem the more those who are content to labour on in perplexity and doubt, but who do not pretend to dictate how and in what manner experience shall determine this and that question. This notion of the connections of polarity which I am attempting to exhibit is one of which we can only form some dim notions before experience and the manner in which those notions become seized upon, and have their place assigned them in the period of our completer knowledge, is very different from that which we have been expecting. It is like a great drama in which we see sympathies and antipathies, loves and hates, elective preferences and strong repulsions; we know that in the end all the subjects of these qualities must form themselves into groups and families, and that all these contradictory and opposing qualities will be reconciled and disposed of; but we cannot see our way to the end of the action, and must wait the close of the last scene to learn the way in which this effect is to be brought about. For instance, I have spoken of chemical polarity; that personage has been already brought upon the stage, but he must enter again with a new companion. The polarity of bodies whose elements have a certain kind of composition must be further conceived as to their relations in space. We have seen the different course taken by the decomposing elements of a body according to their chemical properties, and have called them the anion and cathion, and this chemical consideration also points to relation of space; but have we found anything in the composition of bodies having a more direct relation to space? Certainly we have—the phenomena of crystallization. These phenomena depend on the chemical constitution, and have a most curious relation to space; and thus we have another state of polarity. We have in a crystal the notion of an axis, of several axes opposite to each other; and thus we get the notion of a second kind of polarity,—a polarity having reference to space, as well as a polarity having reference to chemical constitution. Is there any relation between crystallization and the other kinds of polarity we have been considering—light, galvanism, magnetism, &c.? A few weeks ago we must have said, in answer to such a question, that we did not know; but Mr. Faraday and Dr. Plucker have enabled us to say we do. Those philosophers have found that when a crystal of bismuth is suspended in the magnetic field, between horizontal poles, it immediately either points in a given direction or vibrates about that position, just as a small magnetic needle would do, and that if disturbed it returns to this position. When the crystal is suspended a second time, and the horizontal line, which is transverse to the magnetic axis, becomes the vertical line, the crystal attains its highest degree of force. If it be again resuspended, so that the line which is parallel to

the magnetic axis be rendered vertical, the crystal loses all its directive force, and the phenomena are, it is found, dependent on the crystalline form, since, if the same material in an uncrystalline condition be taken, the magnocrystalline results disappear. Mr. Faraday considers the force as dependent on the crystalline condition of the body, and thus associated with the original molecules of matter. In this way the labours of our countrymen have a direct tendency to develop more and more the importance of magnetism,—a power which is found to influence all bodies, and which, though a few years ago known only by two of its phenomena, is now recognised as sustaining the most intimate relations with electricity, heat, chemical action, and light itself.

And now let us see what we have got. We have various kinds of polarity. We have chemical polarity, connected with galvanism; galvanism connected with magnetism; magnetism connected with crystallization; and crystallization connected with chemical constitution again;—and thus we seem to have got a complete cycle. But this cycle of polarity will not bear examination, for that chemical polarity which I have placed at the beginning of the series is spoken of in two different senses,—one connected with galvanism as a polarity of synthesis and analysis; and the other with crystallization, or the polarity of construction, or systasis, as I prefer to call it. The two kinds of chemical polarity are different, and this difference between the polarity of a body ceasing to be, or beginning to be, and the polarity of a permanent structure, is a most perplexing point. Although on many points connected with polarity the boldest and most ingenious theories have been ventured on, I do not know that any one has ever undertaken to tell us how it is that bodies which produce a crystalline form, while their composition remains permanent, give off a galvanic current when their constitution is broken up. Any theory, however clumsy and extravagant, which should account for this would be received with thanks. How and why a body should crystallize when its composition is not disturbed, and give off a galvanic current when it is disturbed, is a mystery which philosophers would be very glad to fathom. To bring up our cycle to completeness we want a link supplying. We have not got any complete chain of connection between all the elements. We have got various hypotheses by which the connection of one kind of polarity with another may be more or less explained. The explanations from the number of facts which they account for are valuable, but the theory which explains best the polarization of light is opposed by that suggested by the phenomena of crystallization; and an immeasurable number of facts connected with that theory, the theory of transverse vibrations, has not been brought into connection with other kinds of polarity. If we consider the power of the magnet as made up of transverse currents, yet we cannot say how those currents are determined, and how the doctrine can be reconnected with former theories. The galvanic theory of momentum throws great difficulty in the way of giving consistency to speculations on the latter subject, and still more on connecting it with what we already know of other facts of the subject of polarity. The connection of crystallization with chemical structure is exceedingly difficult to understand in any definite sense, and all the attempts of various philosophers to explain it have been followed by very unimportant results. But in the midst of this doubt and perplexity it is still to be remembered that these theories, diverse as they may at first appear, are all, inasmuch as they take hold of facts, helping on in different ways the completeness of truth. In all ages the most opposite theories have been held on subjects of which the knowledge of mankind has been imperfect, and those opposite theories have been modified by each other and by new discoveries, so that the difference of explanation they gave has at last been found to be one of expression rather than of conception. Coulomb's theory was that there are two electric currents, determining themselves to various parts of a body, one to the outer surface, the other to the interior of bodies. You are aware that Dr. Faraday has given us a theory opposed to this view of the subject. He supposes that electric induction does not take place on straight lines, but that it acts through a series of particles, and that the lines through which the action takes place are curved lines. You have a series of polar particles with their elements arranged alternately, positively, and negatively. In this manner all hypotheses are made to resolve themselves into one another, and as one succeeds another the notion of polarity comes at last to be expressed in more general and abstract terms than was before possible. Thus lines of polar action, luminiferous vibrations, lines of crystallization, and other notions will, perhaps, be found to have a relation to each other proceeding from a few general principles. But if ever we are to do this it will be necessary to hold firmly to our inductive plan of investigation, keeping a few guiding principles in view, among which, and above all, stands the idea on which I have this evening attempted to fix attention, the idea of polarity.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ANALYSES OF SEVERAL VARIETIES OF EPIDOTE.

By M. HERMANN.

ZOISITES.

Grey Zoisite from Falltigel, in the Tyrol. Found imbedded in granite.

Density, 3.28.

Composition.

Silica	40.95
Alumina	30.24
Lime	21.56
Protoxide of iron	4.96
Carbonic acid	1.13
Water	0.56
	99.40

The results of this analysis agree with those obtained by M. Geffken and other analysts.

Green Zoisite from Arendal.

Density, 3.17.

Composition.

Silica	37.32
Alumina	22.85
Lime	22.03
Magnesia	00.77
Peroxide of iron	11.56
Protoxide of iron	1.86
Carbonic acid	2.64
Water	0.29
	99.32

Green Zoisite from Achmatowsk.

Density, 3.33.

Composition.

Silica	37.32
Alumina	22.85
Lime	22 03
Magnesia	00.77
Peroxide of iron	11.56
Protoxide of iron	1.86
Carbonic acid	2.64
Water	0.56
	99.59

Green Zoisite from Schumnaja.

Density, 3.43.

Composition.

Silica	36.45
Alumina	24.92
Lime	22.45
Peroxide of iron	9.54
Protoxide of iron	3.25
Carbonic acid	2.73
Water	0.77
	100.11

PISTAZITES.

Pistazite from Arendal, in large crystals of a dark green colour.

Density, 3.49.

Composition.

Silica	36.79
Alumina	21.24
Lime	21.27
Peroxide of iron	12.96
Protoxide of iron	5.20
Carbonic acid	2.31
Water	0.55
	100.32

The results of this analysis agree with those obtained by Rammelsberg, Geffken, and Kühn.

Pistazite from Burowa, south of Miask. Found imbedded in quartz.

Density, 3.35.

Composition.

Silica	36.87
Alumina	18.13
Lime	21.45
Magnesia	0.40
Soda	0.08
Peroxide of iron	14.20
Protoxide of iron	4.60
Carbonic acid	0.89
Boracic acid	a trace
	96.62

Pistazite from Werchnenwinsk (called also Puschkinite). This mineral is found in crystals of red or green colour, according to its position to the light.

Density, 3.43.

Composition.

Silica	37.47
Alumina	18.64
Lime	22.06
Soda (with traces of lithia)	2.28
Peroxide of iron	14.15
Protoxide of iron	2.56
Carbonic acid	0.79
Water	0.65
Boracic acid	a trace
	98.60

Pistazite from Bourg d'Oisans (Dauphiny). This mineral has an olive-green colour.

Density, 3.38.

Composition.

Silica	37.60
Alumina	18.57
Lime	21.19
Magnesia	1.40
Peroxide of iron	13.37
Protoxide of iron	5.55
Carbonic acid	1.22
Water	0.46
	99.36

Pistazite from Achmatowsk. The colour of this mineral is grass-green.

Density, 3.39.

Composition.

Silica	37.38
Alumina	18.25
Lime	24.72
Magnesia	0.39
Soda	0.91
Peroxide of iron	12.31
Protoxide of iron	2.20
Carbonic acid	1.61
Water	0.59
Boracic acid	a trace
	98.36

Bucklandite.—This mineral, which has hitherto been taken for black sphene, is found at Achmatowsk, in isolated crystals, imbedded in calcareous spar, and accompanied by garnet and diopside. Its form and admeasurements agree with those of other epidotes.

Density, 3.51.

Composition.

Silica	36.97
Alumina	21.84
Lime	21.14

Peroxide of iron	10.19
Protoxide of iron	9.19
Carbonic acid	0.32
Water	0.68
	100.33

Orthite, or ceriferous epidote.

The mineral Tschewkinite is often confounded with the orthite of Miask. These two minerals differ, however, considerably in density, the density of the former being 4.50, whereas that of the latter is only 3.5.

Compositian of the Orthite.

Silica	34.47
Alumina	14.36
Lime	10.20
Magnesia	1.08
Peroxide of iron	7.66
Protoxide of iron	8.24
Oxide of ecrium	14.79
Oxide of lantanium	7.66
Water	1.56
	100.02

—*Journal de Chimie et de Physique*, Sept., 1848.

ANALYSES OF THE DIFFERENT PHOSPHATES OF MANGANESE.

By M. W. HEINTZ.

Phosphate of Manganese.

This salt is prepared by precipitating the solution of a manganese salt with the common phosphate of soda, redissolving the precipitate in phosphoric acid, and evaporating the solution. The salt separates in small prismatic crystals, which are readily soluble in water, but insoluble in alcohol.

The salt is composed of :—

Phosphoric acid	48.98	to	49.17
Protoxide of manganese	25.42	to	24.60
Water of hydration	13.24	to	12.77
Water of crystallization	13.19	to	13.24
	100.83		99.78

The crystallization water is expelled at a temperature of 230 to 248° Fahr.

Triphosphate of Manganese.

This salt is obtained by precipitating a solution of sulphate of manganese with the common phosphate of soda.

The triphosphate of manganese is a perfectly amorphous white light powder, very sparingly soluble in water.

It is composed of :—

Phosphoric acid	29.32	to	29.82
Oxide of manganese	43.91	to	43.66
Water expelled between 230 and 248° Fahr.	15.95	to	15.85
Water expelled by calcination of the salt	11.32	to	11.12
	100.50		100.45

Ammonio-Diphosphate of Manganese.
(Otto's salt.)

To prepare this salt a solution of sulphate of manganese containing an admixture of ammonia and sal ammoniac is gradually dropped into an ammoniacal solution of phosphate of soda. A viseid precipitate is produced, which changes after some time to crystalline scales.

Otto's salt is composed of :—

	Otto.	Heintz.
Phosphoric acid	37.86	38.37
Oxide of manganese	37.84	38.35
Ammonia	9.16	23.51
Water	15.14	
	100.00	100.23

Diphosphate of Manganese.

This salt is prepared as follows :—Acidulate a solution of sulphate of manganese with acetic, hydrochloric, or phosphoric acid, and add to the acidulated solution common phosphate of soda until a permanent precipitate forms (the precipitate which makes its appearanec upon the first addition of the phosphate disappears again). The precipitate changes after some time into a reddish crystalline mass, which is sparingly soluble in water, but readily so in acids.

This salt is composed of :—

Phosphoric acid	34.61	to	34.86
Oxide of manganese	34.58	to	34.43
Water expelled between 230 and 248° Fahr.	23.30	to	22.05
Water expelled at 392° Fahr.	4.23	to	4.23
Water expelled by calcination of the salt	4.38	to	4.38
	101.10		99.95

—*Journal de Physique et de Chimie, Novembre*, 1848.

ON THE ACTION OF NITRO-SULPHURIC ACID (A MIXTURE IN EQUAL PROPORTIONS OF FUMING SULPHURIC AND FUMING NITRIC ACIDS) ON ORGANIC SUBSTANCES.

By M. AUGUSTUS CAHOURS.

In my essay on salicylate of methylene I have shown that this compound, when acted upon by small quantities of nitric acid, and care being taken to cool the mixture, exchanges one equivalent of hydrogen for one of nitrous vapour, giving thus birth to indigolate of methylene ; and that, if the quantity of the acid is increased, and the precaution of cooling the mixture omitted, a very energetic action is produced, resulting in the loss of an additional half equivalent of hydrogen, which is replaced by one half equivalent of hyponitric vapour.

The curious researches of M. Pelouze on pyroxyline, and the facility with which binitrate of benzene is produced by Hofmann's process, which consists simply in treating benzene with a mixture of fuming nitric and concentrated sulphuric acids, induced me to try the same process upon salicylate of methylene, anisic acid, benzoic acid, cuminic acid, mesitylene, in the hope of producing new compounds complementary of the several series to which those substances respectively belong.

ACTION OF THE NITRO-SULPHURIC MIXTURE UPON SALICYLATE OF METHYLENE.

If salicylate of methylene is added drop by drop to a mixture in equal proportions of fuming nitric and sulphuric acids, care being taken to refrigerate the mixture by affusions with cold water, a transparent liquid is obtained of deep orange-yellow colour. The addition of the salicylate of methylene is to be continued until the drop last added refuses to dissolve ; a small quantity of the nitro-sulphuric mixture is then addded, and the vessel gently shaken until complete solution is effected. The mixture is then left at rest for some minutes, and subsequently diluted with from seven to eight times its own volume of water, when a solid, heavy, light yellow matter is deposited. This matter is insoluble in water even at 212° Fahr., nor does it fuse at that temperature. It is almost insoluble in cold, but dissolves readily enough in boiling, alcohol ; from its solution in the latter menstruum it separates again almost completely, upon cooling, in form of crystalline scales, having a slight yellow tint, which may be almost completely removed by one or two recrystallizations.

The specific gravity of this new substance is greater than that of water. It fuses between 255 and 257° Fahr., forming a light yellow liquid, which upon cooling turns into a fibrous mass. If this new substance is heated cautiously in a small closed glass tube or in a glass retort, it volatilizes completely, recondensing in form of very brilliant thin scales ; if it is heated rapidly it deflagrates and suffers total decomposition, emitting a black smoke, and leaving a copious carbonaceous residue behind.

With alkaline bases it comports itself like a true acid ; it forms soluble and crystallizable salts with potass, soda, and ammonia.

Most highly concentrated sulphuric acid dissolves it with the aid of a gentle heat ; upon addition of water to this solution, it precipitates unaltered in form of small, very brilliant, and almost colourless scales.

If, instead of applying a gentle heat (from 86° to 104° F.), we raise the temperature of the mixture to from 167° to 176° F., an energetic reaction takes place ; carbonic acid is disengaged abundantly, and the liquid assumes a red tint. If the temperature is raised gradually only (which may be effected by interrupting the process of heating from time to time, and immersing the tube containing the mixture in cold water), disengagement of the carbonic acid alone is observed. Addition of water to the mixture renders the liquid opalescent, and, upon cooling, small yellow crystalline needles are deposited, which dissolve readily in boiling water and in hot alcohol, from which solutions they are deposited again upon cooling, in the same form of fine, brilliant needles. If the temperature of the mixture of sulphuric acid and the new substance (which we will for the present call binitric salicylate of methylene), the temperature is raised to above 212° F., the action becomes most energetic, and is attended not only with evolution of carbonic, but also with disengagement of a copious amount of sulphurous, acid ; the mixture turns black, and the addition of water occasions separation of amorphous brown flakes.

Fuming nitric acid dissolves at 86° to 104° F. the binitric salicylate of methylene unaltered ; upon addition of water to the solution, the latter substance separates again in its original state. By long-continued ebullition with nitric acid, however, the binitric salicylate of Methylene is decomposed and converted completely into picric acid. Nitric acid of commerce comports itself in this respect in the same manner as the fuming acid.

In concentrated and boiling hydrochloric acid the binitric salicylate of methylene is as insoluble as in pure water.

It dissolves in aqua regia, with the aid of a gentle heat ; upon cooling it is deposited again from this solution in form of fine needles, of slightly yellowish colour.

The analysis of the binitric salicylate of methylene gave the following results :—

I. 0.702 grm. of matter yielded 0.161 grm. of water and 1.019 of carbonic acid.

II. 0.750 grm. of the same sample yielded 0.179 of water and 1.080 of carbonic acid.

III. 0.405 grm. of the same sample yielded 39 cubic centimetres of nitrogen at the temperature of 51.8 Fahrenheit, and under an atmospheric pressure of 759 millimetres (about 29.8), the gas being saturated with moisture.

IV. 0 550 grm. of another sample yielded 0.122 of water and 0.797 of carbonic acid.

V. 0.150 grm. of the same sample as IV. yielded 61 cubic centimetres of nitrogen at the temperature of 55.4 Fahrenheit, and under an atmospheric pressure of 757 millimetres (about 29.7), the gas being saturated with moisture.

VI. 0.650 grm. of another sample yielded 0.149 of water and 0.939 of carbonic acid.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.	IV.	V.	VI.
Carbon	39.57	39.37	..	39.51	..	39.43
Hydrogen.	2.54	2.62	..	2.46	..	2.54
Nitrogen	..	..	11.47	..	11.76	—
Oxygen	—	—	—	—	—	—

which agrees with the formula—

$$C_{16}\,H_6\,N_2\,O_{14}.$$

We have theoretically :—

C^{16}	1200	39.66
H_6	75	2.48
N_2	350	11.57
O_{14}	1400	46.29
	3025	100.00

We have already mentioned that the binitric salicylate of methylene forms soluble and crystallizable salts with potass, soda, and ammonia. It combines equally with the oxides of lead, copper, and silver. The salts which it forms with these oxides are very sparingly soluble in water, and may be produced by the method of double decomposition.

Since, in my essay on that substance, I have called the salicylate of methylene gaultheric acid, I will here call the binitric salicylate of methylene *binitro-gaultheric acid.*

Binitro-gaultherate of Ammonia.—This salt is produced by dissolving, with the aid of heat, the binitro-gaultheric acid in a slight excess of caustic ammonia, and leaving the solution to cool slowly. Transparent yellow needles are deposited; these needles are very sparingly soluble in cold, but dissolve largely in boiling, water. Upon addition of an acid to the solution, the binitro-gaultheric acid separates unaltered.

The analysis of the binitro-gaultherate of ammonia gave the following results:—

I. 0.500 grm. of substance yielded 0.154 of water and 0.677 of carbonic acid.

II. 0.578 grm. of the same sample yielded 0.184 of water and 0.785 of carbonic acid.

III. 0.534 grm. of the same sample yielded 72 cubic centimetres of nitrogen at the temperature of 51.8 Fahr., and under an atmospheric pressure of 75.6 millimetres (about 29.6), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.	III.
Carbon.....	36.92	37.02	—
Hydrogen ..	3.41	3.53	—
Nitrogen	..	..	16.02
Oxygen	—	—	—

Theoretically we have:—

C_{16}	1200	37.07
H_9	112.5	3.47
N_3	525	16.21
O_{14}	1400	43.25
	3237.5	100.00

The rational formula of this salt is accordingly:—

$$C_{16}\,H_5\,N_2\,O_{13}, NH_3, HO.$$

Binitro-gaultherate of Silver.—This compound is produced by adding solution of nitrate of silver to a dilute solution of binitro-gaultherate of ammonia. The new silver salt subsides in form of a fine yellow powder resembling chromate of lead.

The analysis of the binitro-gaultherate of silver gave the following results:—

I. 0.455 grm. of matter left upon calcination a residue of silver weighing 0.139 grm.

II. 0.500 grm. of the same sample yielded 0.062 of water and 0.498 of carbonic acid.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.
Carbon	..	27.15
Hydrogen	..	1.37
Silver	31.24	—
Nitrogen	—	—
Oxygen	—	—

Theorctically we have:—

C_{16}.....	1200	27.50
H_5.....	62.5	1.43
Ag	1350	30.94
N_2	350	8.02
O_{14}	1400	32.11
	4362.5	100.00

[*To be continued.*]

ON THE PRODUCTS OF THE SODA MANUFACTURE.

By JOHN BROWN, Esq.

[*Continued from page* 163.]

II. This brings us to the consideration of the second part of the process, namely, the conversion of sulphate of soda into crude carbonate of soda or British barilla.

This is effected by the combined action of coal and carbonate of lime. The following table shows the proportions commonly used:—

	cwt.	qrs.	Per cent. lbs.	Theoretical quantity. lbs.
Sulphate of soda..	2	2	100	100
Ground limestone	2	2½	102.9	105.3
Coal dross	1	3	61.7	33.6

These, after being intimately mixed, are introduced into a reverberatory furnace and strongly heated. The mass soon becomes soft, when care must be taken to stir it frequently, in order to expose a fresh surface to the heat. When it becomes of the consistence of dough the chemical action commences, and jets of inflamed carbonic oxide begin to issue from it. The evolution of gas soon becomes very rapid, so much so that the whole mass appears to be in a state of ebullition. When this ceases the operation is completed, and the fused mass is raked out of the furnace and allowed to solidify. The cake thus obtained is the crude carbonate of soda, or, as it is technically called, "soda-ball" or "black ash."

This process consists of two sub-processes, which might be carried on in separate furnaces. 1. The coal is consumed at the expense of the oxygen of the sulphate of soda, causing the formation of sulphuret of sodium and carbonic oxide:—

$$NaO, SO_3 + 4C = NaS + 4CO.$$

2. The sulphuret of sodium thus formed is decomposed by the carbonate of lime, with the formation of sulphuret of calcium and carbonate of soda:—

$$NaS + CaO, CO_2 = NaO, CO_2 + CaS.$$

But if this compound were digested in water a reverse action would immediately take place, sulphuret of sodium and carbonate of lime being again formed. To obviate this difficulty, a large excess of lime is used in the process, nearly twice as much as would otherwise be absolutely necessary. This excess of lime causes the formation of a compound insoluble in water, the composition of which is 3CaS, CaO. This substance has no effect on a solution of carbonate or caustic soda.

ANALYSIS OF SODA BALL, OR CRUDE CARBONATE OF SODA.

An average sample was obtained by pounding a large quantity of the soda ball, and from this the specimens analyzed were taken.

1. *To Estimate the Amount of Soluble and Insoluble Salts.*—A portion of the substance was thrown on a weighed filter and washed with water at about 120° F., until a portion of the filtered liquor left no residue on evaporation; the filter and insoluble matter were then dried in a water-bath and weighed.

Soda ball.	Insoluble matter.	Soluble matter.
100 gave..	59.87	40.13
100 " ..	58.92	41.08
100 " ..	59.90	40.10
Average..	59.56	40.43

2. *Sulphate of Soda.*—After saturating the soda ball with pure muriatic acid, and separating the insoluble matter by filtration, the sulphuric acid was precipitated by chloride of barium.

Soda ball.	BaO,SO_3.	BaO, SO_3 per cent.	NaO, SO_3 per cent.
245.20 gave	8.50	3.466	2.147
110.00 "	1.30	1.181	0.733
78.36 "	0.76	0.969	0.601
Average		1.872	1.160

3. *Chloride of Sodium.*—The soda ball was digested with nitric acid and filtered, and from the filtered solution the chlorine was precipitated by nitrate of silver.

Soda ball.	Ag Cl.	Cl.	Na Cl.	Na Cl. per cent.
98 gave	5.400	1.350	2.250	2.295
100 "	3.679	0.912	1.532	1.532
Average				1.913

4. *Soda.*—The total quantity of available soda, that is, soda existing as carbonate, sulphuret, and hydrate, was determined in the following manner:—A portion of the soda ball was thrown on a filter and washed with warm water until all the soluble matter was taken up; the filtered solution was then exactly neutralized by dilute sulphuric acid, which was afterwards precipitated by chloride of barium. From the quantity of sulphate of barytes thus obtained the amount formerly got from the sulphate of soda was deducted, and from the remainder the per centage of alkali was calculated.

Soda ball.	BaO,SO_3.	BaO,SO_3 p.c.	Soda p.c.
44.60 gave	40.60	91.031—1.872=89.159	24.593
100 "	88.96	88.960—1.872=87.083	24.034
48.50 "	42.76	88.164—1.872=86.292	23.800
Average.....			24.138

5. *Sulphur.*—The amount of sulphur was determined in two different ways:—1st. The soda ball, after being very carefully pulverized, was intimately mixed with about four times its weight of nitrate of potash and heated in a covered platinum crucible. The nitrate of potash was thus decomposed, and the sulphur converted into sulphuric acid by the oxygen of the nitric acid:—

$$KO, NO_2O_3 + S = SO_3 + KO + NO_2.$$

The fused mass was dissolved by muriatic acid, and, after filtering the solution, the sulphuric acid was precipitated by chloride of barium. 2. The soda ball, moistened with a small quantity of water, was intimately mixed with a quantity of finely pulverized chlorate of potash, and to this muriatic acid was added, drop by drop, until upon a fresh addition of acid no more gas was evolved. The flask containing the substance was then gently heated by means of a water-bath, care being taken to keep the temperature below 180° F., as chlorous acid explodes with great violence at about 200° F. When all action had ceased the solution was filtered, and the sulphuric acid precipitated by chloride of barium. From the weight of the sulphate of barytes thus obtained, the former quantity, 1.872, was deducted, and from the number thus found the amount of sulphur was calculated.

	Soda ball.	BaO, SO_3.	BaO, SO_3 per cent.	Sulphur per cent.
By 1st method.	19.34 gave	17.90	92.554—1.872=90.628	12.507
	19.53 "	18.20	93.189—1.872=91.317	12.595
By 2d method.	28.90 "	27.00	93.425—1.872=91.553	12.627
	29.60 "	27.20	91.891—1.872=90.019	12.416
			Average	12.536

6. *Magnesia.*—This was precipitated by ammonia and phosphate of soda.

Ball soda.	$2MgO,P2O_5$.	MgO per cent.
100 gave	0.980	0.350

7. *Silica and Sand.*—The soda ball was dissolved in muriatic acid and the solution evaporated to dryness. The residue was then digested with strong muriatic acid, and the insoluble matter separated by filtration.

Ball soda.	Silica and Sand.	Silica and Sand per cent.
56.00 gave	4.30	7.679

The silica was separated from the sand by strong caustic potash.

Ball soda.	Sand.	Sand per cent.	Silica per cent.
56.00 gave	2.40	4.285	3.394

8. *Iron and Alumina.*—A portion of the soda ball was dissolved in muriatic acid, and, after separating the insoluble matter, the iron and alumina were separated by caustic ammonia.

Ball soda.	Al_2O_3&Fe_2O_3.	Al_2O_3& Fe_2O_3 per cent.
61.20 gave	3.45	5.637
19.53 "	1.15	5.888
29.10 "	1.45	4.982
Average		5.502

The peroxide of iron was separated from the alumina by caustic potash.

Ball soda.	Fe_2O_3.	Fe_2O_3 per cent.	Fe per cent.	Al_2O_3 per cent.
61.20 gave	2.94	4.804	3.363	0.833
29.10 ..	1.20	4.123	2.886	0.859
Average			3.129	0.846

9. *Lime.*—From the solution filtered from the alumina and iron the lime was precipitated by oxalate of ammonia.

Ball soda.	CaO, CO_2.	CaO.	CaO per cent.
61.20 gave	33.00	18.480	30.194
29.10 ..	15.50	8.680	29.828
21.80 ..	12.05	6.748	30.954
Average			30.325

10. *Carbonic Acid.*—By the addition of muriatic acid to the ball soda, sulphuretted hydrogen and carbonic acid gases were evolved, which were passed through a strong solution of caustic barytes. The precipitated carbonate of barytes was filtered as rapidly as possible, care being

taken to keep it covered with a plate of glass during the process.

Ball soda.	BaO, CO_2.	CO_2.	CO_2 per cent.
45.35 gave	28.90	6.487	14.304
90.18 ..	59.20	13.289	14.736
		Average	14.620

11. *Carbon.* — To determine the amount of carbon, a portion of the ball was treated with muriatic acid and the solution evaporated to dryness; dilute acid was then added, and the insoluble matter thrown on a filter which had been previously dried at 212° and weighed. The total amount of carbon, silica, and sand, was thus ascertained. The whole was then ignited and weighed, and from the loss the per centage of carbon was calculated.

Ball soda.	Insoluble matter.	Carbon per cent.
100 gave	15.941, which lost on ignition	7.998

12. *Water.*—The soda ball was dried at 212°, and the amount lost estimated.

Ball soda.	Water.	Water per cent.
50.00 lost	0.35	0.700

Whilst washing out the soluble salts it was observed that the filtered solution was of a greenish colour; and upon boiling it a green-coloured substance was deposited, after which the supernatant liquor became perfectly colourless. Upon examining this precipitate, it was found to consist principally of silica and alumina with a little lime. From this it was concluded to be artificial ultramarine, which is frequently found in the crevices of the ball-furnaces, and which, when dissolved in caustic soda, yields a green-coloured solution, precisely the same as that mentioned above.

Ball soda.	Ultramarine.	Ultramarine per cent.
200 gave	0.46	0.23
100 "	0.36	0.36
	Average	0.295

Sulphate of soda	1.160
Chloride of sodium	1.913
Soda	24.138
Lime	30.325
Sulphur	12.536
Carbonic acid	14.520
Sand	4.285
Silica	3.394
Magnesia	0.350
Alumina	0.846
Iron	3.129
Water	0.700
Carbon	7.998
Ultramarine	0.295

—		Soda.	Lime.	Carbon. Acid.	Sulphur.
Carbonate of soda	35.640	21.120	..	14.520	
Caustic soda	0.609	0.609			
Aluminate of soda	2.350	1.504			
Sulphate of soda	1.160				
Sulphuret of sodium	1.130	0.905	..	..	0.454
Chloride of sodium.	1.913				
Ultramarine	0.295				
3CaS+CaO	29.172	..	24.024	..	10.296
Caustic lime	6.301	..	6.301		
Sand	4.285				
Sulphuret of iron	4.917	..	..	..	1.786
Silicate of magnesia	3.744				
Carbon	7.998				
Water (hygroscopic)	0.700				
	100.214	24.138	30.325	14.250	12.536

It will be seen that in the above analysis I consider almost all the soda to be united with carbonic acid, there being very little caustic soda. Unger and others who have examined the soda balls fall into the error of supposing a large quantity of the alkali to exist as hydrate, and also of always finding carbonate of lime; but if a portion of the ball soda be digested in alcohol, and the alcoholic liquor carefully examined, it will be found that it holds in solution a very small quantity of alkali, which I consider to be as sulphuret. If, on the contrary, the soda balls contained caustic soda, it would be immediately dissolved by the alcohol, and we should obtain a strongly alkaline solution. This, however, is not the case. But if the ball soda be digested in water the liquid will be found to contain a large quantity of caustic soda, which, however, can easily be accounted for in the following way. There exists in the ball soda a large quantity of caustic lime; and whenever water is added to it a decomposition takes place, carbonate of soda and caustic lime becoming carbonate of lime and caustic soda:—

$$NaO, CO_2 + CaO = CaO, CO_2 + NaO.$$

Some analysts have also found water of combination in ball soda, that is, water united to soda or lime. But this is impossible, for where does the water come from? The materials contain none. A small quantity of water is certainly formed in the combustion of coal, but this is not sufficient to account for it. The method of analysis pursued in the determination of the amount of water combined with soda or lime was, I think, very incorrect: it was to burn the ball soda with chromate of lead, and determine the weight of the water given off. Had any undecomposed coal existed in the waste it would have contained hydrogen, and water would consequently have been formed, the oxygen being derived from the chromic acid of the chromate of lead.

As might be expected, I found, upon trying samples taken from different furnaces, that the constituents were subject to great variations. Thus the lime varied from 27 per cent. to 34 per cent.; the soda from 22 per cent. to 26.5 per cent.; the sulphur from 10 per cent. to 16 per cent. But they always stood in a certain fixed relation to one another; for when the quantity of lime was large the amount of sulphur was proportionally increased, and the per centage of soda consequently diminished. The following table will suffice to show this:—

	I.	II.	III.
Soda	26.480	22.000	24.138
Lime	26.959	33.807	30.324
Sulphur	10.527	13.820	12.436

I insert here two analyses of soda balls; the one from Cassel by Unger, the other from Newcastle by Richardson. They both get hydrate of soda and carbonate of lime, and are, I think, wrong in both of these, although the other parts of the analysis are probably quite correct.

The manufacture in Cassel and Newcastle is carried on almost exactly in the same way as here.

	From Cassel.	From Newcastle.
Sulphate of soda	1.99	3.64
Chloride of sodium	2.54	0.60
Carbonate of soda	23.57	9.89
Hydrate of soda	11.12	25.64
Carbonate of lime	12.90	15 67
3CaS, CaO	34.76	35.57
Sulphuret of iron	2.45	1.22
Silicate of magnesia	4.74	0.88
Charcoal	1.59	4.28
Sand	2.02	0.44
Water (hygroscopic)	2.10	2.17
	99.78	100.00

[*To be continued.*]

THE CHEMICAL TIMES.

SATURDAY, FEBRUARY 3, 1849.

OUR OWN SERIES.

No. VI.

ON CHEMICAL MANIPULATION.

Indiarubber and Gutta Percha.

One of the most general applications of indiarubber is for the purpose of forming little connectors, and in joining together various pieces of tube apparatus.

The material out of which this is formed is indiarubber in sheets, which may now be procured at most of our large chemical purveyors, or at the manufactory situate in Goswell-street. The laboratory should be supplied with sheets of various thicknesses for the different purposes to which this material will be, under different circumstances, applied. Generally, however, that forming the thickness of delicate shoe leather will be the best; not that this thickness will be usually sufficient for imparting the necessary strength to connectors, but that it is better to use two layers of rubber, in the manner to be described, than one.

In making these connectors a mandril is first to be found. For this purpose a glass rod, or tube, or even a round piece of wood, may be used; indeed, the latter is, perhaps, the best material.

Before commencing the operation the young chemist must well consider the nature of the material with which he has to deal. If he be ambitious of making a very long indiarubber tube, and of cutting the latter when made into lengths, he will invariably fail; for when prepared on the mandril the elastic tube sticks so tightly to the latter that it cannot be slid off. To obviate this difficulty it is recommended by some manipulators to use as a mandril a thin glass tube, and to crush it by a blow so soon as its duty has been performed. This, however, is a very clumsy procedure, and a most inefficient one; for generally minute spiculæ of glass will be found to have entered into the substance of the rubber, and, indeed, frequently to have perforated it, thus altogether destroying the connector's utility, and jeopardizing any experiment for the conducting of which it may be employed. An inch and a half, or at the furthest two inches, will be found long enough for most connectors; and in the preparation of such there is no difficulty. A piece of rubber is cut off sufficient to constitute this length, and not only to go round the mandril, but also to leave, when round, sufficient of each end to be grasped by the finger and thumb. The rubber should now be heated before a fire, or over a spirit-lamp until it becomes very soft, but not melted in the least degree. When thus prepared it should be turned round the mandril, the two ends squeezed together by means of the finger and thumb, and then cut off by one sweep of a clean pair of scissors, also warmed before the fire, they having been previously smeared with oil of turpentine, and subsequently wiped dry. After this treatment a seam of junction will have been effected longitudinally throughout the connector, but not a strong one. In this stage, therefore, it is desirable to press the seam, by small portions at a time, between the nails of the finger and thumb, which causes the seam to be more or less trustworthy, and according to some manipulators the connector may be regarded as complete. We, however, cannot recommend such to be considered perfectly trustworthy when turned out in this state. It is better, therefore, to veneer them by another reinforcement of sheet rubber, only with the difference of making the second seam exactly opposite to the first. This having been accomplished according to the directions already given, the connector may be slid off its mandril in the following manner:—Dip the tube, mandril, and all into some water, and whilst there, by means of the finger nail or the blade of a penknife, slightly raise the ends of the connector from its

mandril, so that a film of water may interpose between the two. This film, by a little dextrous manipulation of squeezing, may be made to extend itself throughout the whole space between the two tubes from one end to the other, which being accomplished, the connector may be without any difficulty slid off. Sometimes, indeed, although such a result cannot be calculated upon, the separation of the connector from its mandril requires no such elaborate treatment, a slight sliding pressure imparted at one end being sufficient; but it will easily be understood that any grasping pressure applied against the connector would only cause it to stick more tightly to the internal core.

In the preparation of these indiarubber connectors we have all along assumed that the material has been worked without the intervention of any varnish or solution. Indeed, such is not necessary to a good result, although there can be no doubt that when employed the connector will be all the stronger.

The substance called vulcanized indiarubber, being a compound of indiarubber with sulphur, which will be further adverted to hereafter, is now made by the manufacturers, Messrs. Lyne and Hancock, into most beautiful tubes, which, when cut into short lengths, will generally serve every purpose to which connectors can be applied, and which, therefore, will frequently obviate the necessity of this manufacture. Nevertheless, in the conducting of *very* delicate experiments the presence of sulphur in them may be a disadvantage.

ON AGRICULTURAL EDUCATION.

It is very amusing for impartial persons to regard the strenuous endeavours with which various conflicting rival political sects, just now, when Parliament has assembled, approach the body of farmers.

Could we trust a tithe of the professions made by those who now so loudly extol the virtues of the farmer, and so whiningly deplore every little depreciation in the selling price of farming produce,—could we assume as real a tithe of the solicitude now expressed for the farming interest by leading men of all shades of politics, from the Protectionist peer on one side to the Free-trading calico-printer on the other,—the farmer would, indeed, be the most cared for of all mortal beings. He is to be educated forsooth; rendered better adapted to the station which Providence has called him to fill; his mind is to he developed, his powers directed. This is the grand aim, this the end proposed by all:—

"Hinc mens, animusque,
Fert et amat spatiis obstantia rumpere claustra."

But what this education should be, and how to impart it, is not so clear.

First upon the educational tapis come Messrs. Cobden and Bright, who, having offended the farming interest by their free-trade measures (whether reasonably or justly we will not stop to discuss), now come forward with the ten-million scheme as an incentive to an amalgamation of the agricultural with the manufacturing powers. The farmers, having been nurtured in the old faith, which taught them to consider the landed aristocracy as their only friends, and the manufacturing interest as their natural enemies—the very antichrist of the farming body—naturally enough were slow to appreciate the teaching of the Manchester apostles. The free-trade broadsheet, however, circulated far and wide—the financial reform tracts have made an impression—the Manchester lesson in political economy sank deep—the Protectionist landlords became afraid, and are now up and stirring. They, too, have their code of education for the farmer, as propounded in many a silly postprandial oration, amidst a vulgar, inane abuse of the Free Traders. This code, too, has produced its fruits: farmers in abundance can be found so deeply committed to the Protectionist doctrines, that they will rail by the hour against Sir Robert Peel, the *Times*, and free trade, in a way that must be perfectly delightful to their Graces of Richmond and Newcastle, and must be warmly acceptable to the manes of Lord George.

Mr. Ellerman, who spoke at the late Sussex Agricultural Protection Society, is an accomplished pupil of this school:—

"How the English farmer," remarked the speaker, "could cultivate his land at a profit, when the door was open at all prices to foreign corn, he could not imagine. Agriculture abroad had been much improved of late, and was daily improving. Mr. Jonas, of Cambridge, stated at a meeting last Friday that a few days previously he had on his farm two farmers, one of them a nephew of Mr. Bates, one of the first breeders of shorthorns, and he stated that he and his brother had purchased an estate in Prussia, on the banks of the Elbe, whither they were going to transfer their capital and their skill, for the purpose of sending their produce to the English market. Mr. Jonas inquired the freight of wheat, and the reply was, 'About 4s.;' and the rent was not one quarter, and the wages not one fifth of what were paid here. With such facts before them, who could say to what extent we should be overwhelmed by foreign wheat?—(Hear, hear.) He could not pay Mr. Bates the compliment which was wittily paid to a person transported, that 'he left his country for his country's good.' He left his country to raise corn to send back, in order to assist still further in ruining the friends whom he left behind."

Illustrations are awkward things;—weapons with two cutting edges and a sharp point; dangerous to be meddled with by narrow-minded partisans. Whilst Mr. Ellerman shrouds himself in the big grandiloquent conventionalities of his party, and talks abstractedly about the landed interest as the natural protectors of the farmer; the tergiversation of Sir Robert; and all that kind of eloquence, he is very well: but no sooner does he produce some tangible instance in favour, as he thinks, of his cause than he furnishes his antagonists—we will not say his enemies, although he thinks so—with a two-edged weapon with a point. A Mr. Bates, it would appear, can succeed better in his calling,—more remuneratively,—in Prussia than in England. He therefore goes to Prussia, and prospers. Now, where the great mischief—where the injustice of this?

Why, rejoins the speaker, the mischief is this:—Mr. Bates sends produce to England, and undersells his friends at home. The remedy seems to us very clear: he has too many friends at home—they should follow him. But to what extent?—until when? The reply seems to us exceedingly simple. Until so many had emigrated that the productive faculty of England and the banks of the Elbe had become equalized.

This case, no doubt, will appear very monstrous to Mr. Ellerman;—will seem to strike at the root of nationality, all preconceived notions, to sap the very foundation of society. We douht not that he will picture to himself, first, the depression of rents by the landed interests; next, the foreclosing of hungry mortgagees; then the landed aristocracy obliged to disgrace themselves by educating their sons to commercial pursuits. *How* soldiers and sailors are to be made if labourers are to be starved he cannot tell; *how* farmers are to till their corn if they cannot pay the labourers he is at a loss to divine; *how* the hereditary aristocracy *is* to exist if it be mortgaged, and if it cannot reduce the rent roll,—without falling into the hands of the Jews, is a mystery; and *how* the country *is* to stand if the landed aristocracy abate its rents, or mix in productive operations, or fall into the hands of the Jews, is a question rather to be shuddered at than propounded!

This is, indeed, a long list of sad contingencies; but it will be seen they all depend upon the assumption that not only must there be a high aristocracy (an opinion in which we entirely concur), but that it must be an hereditary aristocracy, whose only source of income is land.

Never was there a greater fallacy. To this aristocracy the farmers have been taught to look up, not with the honest independence of one man to another, but as inferior beings in the scale of humanity to superior ones—of feudal retainers to their chiefs—nay, often of mortals to demigods. Such has been a part of the farmer's education—such are the sentiments into which he has been drilled—such are the class feelings which are now sought to be perpetuated. Even that Coryphæus of moderate advance, Sir Robert, seeks to uphold, in his model school of Tamworth, so munificently endowed by "*my father*," the serf-like dependence between the farmer and his lord; as may be recognised by the offensively patronizing cant in which he propounds to the farmers his intention that their sons shall be provided with a schoolmaster, rejoicing in the munificent sum of seventy pounds a year:—

"I shall invite," remarks Sir Robert, "the middle class who reside here or in the neighbourhood, including farmers, shopkeepers, retail dealers of all descriptions, to send their sons to the school, where they will receive a first-rate education—I will not say a classical education—but including all those departments of knowledge useful to such persons—geography, natural philosophy, history, science in its different branches."

Can there be anything more offensive than the cant of this annouucement, or the sentiment of inferiority conveyed by the whole tenour of the extract?

Such a plan of education we could imagine propounded by some Russian despot for his serfs,—a plan that should render them only so conversant with useful knowledge as might conduce to their master's behests; whilst every free and noble aspiration should be crushed in its early birth.

But now for a practical suggestion, without which our castigation of things that be were

vain. Now for *our* scheme of a farmer's education. It is very short, though very comprehensive, much more so than the scheme of Sir Robert: we believe, too, it is equally cheap. *We* would begin by laying a good foundation, without which all the worthy baronet's learning fit for "*such people*" would wither and die. Strange, too, to say, the foundation, although we guarantee it strong, is but a sentiment! We would begin by creating the sentiment in the English farmer's breast that he ought to be, if he be not, an English gentleman. *This* is the foundation of our farmer's educational code. Create this sentiment, and the remainder of his education will easily come. Of course we expect to raise a vulgar laugh from the landed interest, who periodically expound the mysteries of protection to bands of tenants, crowded together on rent days, in servants' halls. Laughter, however, is no argument; neither is there power in abuse. The nineteenth century is no sluggard, but speeds along in rapid course:—breaking down prejudices—redressing wrongs:—vindicating the powers of mind, and flooding myriads of cherished fallacies with a sea of light.

THE APOTHECARIES' COMPANY AND DR. SHERIDAN MUSPRATT.

On all occasions, when circumstances required us to speak of the London Apothecaries' Company, we have testified to the laudable anxiety which that body has evinced in improving the education, and therefore the efficiency and the status, of their licensees. Actuated by a desire to elevate the English apothecary into a position very different from the mere physician's drudge of ancient times, the court of examiners have wisely deemed it the best means of attaining that desirable end by securing to their candidates for diplomas a high professional training; and we are bound to say that in their recognition of lecturers hitherto they have manifested no more of exclusiveness than a due professional conservatism should warrant.

Having accorded these our sentiments, we may well be allowed to express our astonishment that the learned society adverted to has declined to recognise the certificates of our correspondent and contributor, Dr. Sheridan Muspratt, who, to his great praise be it spoken, has succeeded in establishing a school or college of chemistry at Liverpool, after the model of the young, but thriving, metropolitan prototype.

As a preliminary to the expression of our own opinions on this matter, we must candidly confess our dissent from an inference conveyed by Dr. Muspratt's letter to the *Liverpool Mercury*, in which journal the doctor, after commenting on the fact that the College of Surgeons has awarded a recognition which is refused by the Apothecaries' Company, concludes by the following expression:—

"I am sorry for the medical students, who were so complimentary to me, that their request has been refused. It was, however, granted in the Royal College of Surgeons—an honour, a very great one, paid to me, as it is the only instance of a private professor being recognised by the first examining board of surgeons in the world."

Feeling as we do that the College of Surgeons has simply done justice to our friend, and that the Apothecaries' Company have done him an injustice, we are sorry that the extract already quoted bears a construction so different from our own that we profess our inability to urge Dr. Muspratt's case in the manner indicated by himself. For much as we respect the chemical talents of Dr. Muspratt, and of many others,—we will say *most* of the British gentlemen known to chemical fame,—we should look with fear on the temerity of the College of Surgeons, or any other community, that might consider itself warranted in breaking down a precedent, and creating an exclusive advantage, in deference to any one, out of many individuals engaged in the same pursuit.

The College of Surgeons has awarded to Dr. Muspratt that simple meed of justice which we have never known it refuse to *any* lecturers, public or private, who could bring adequate testimonials of competence in their several pursuits.

The Apothecaries' Hall has taken another course—very much to be regretted by its own members, no less than by Dr. Muspratt, and the students of this gentleman's class—and has quoted a precedent for the taking of this course which in reality does not exist—never has existed. The company appeals to a by-law of theirs that no certificate of attendance at lectures can be recognised except the latter have been delivered by some one in connection with a medical school. This assertion is monstrous—nothing can be wider of the truth. Is the Polytechnic Institution of London a medical school, we beg to ask the court of examiners? Is the Royal Institution? And do not certificates of attendance on the chemical lectures at either of these institutions pass muster at the hall? Were it not so, indeed, medical students would be deprived of the instruction of a Brande and a Faraday,—a thing too monstrous for any by-law. But why do we thus expatiate on these two cases, when we find a host of lecturers springing up outside the walls of medical schools, yet in connection with none,—venders of cheap botany, cheap chemistry, and an incongruous *omnium gatherum* of law and poison, yclept forensic medicine,—these lecturers all having without difficulty obtained their recognition from the hall?

If our remarks be true, and they can be easily proved, the refusal to grant Dr. Muspratt his recognition involves too great a mixture of absurdity with injustice to be sustained. We feel confident the Society of Apothecaries will rescind their decree.

ANOTHER VERDICT OF MANSLAUGHTER AGAINST MR. DROUET.

It matters not now with what protecting technicalities the Tooting child-farmer may envelop himself, and secure a legal immunity from the two verdicts of manslaughter which have been, by two separate coroners' juries, brought against him. The moral effect will have been no less achieved. The public will no longer consent to allow children of the friendless but deserving poor to be immured in gigantic pest-houses, there to be reduced, by negligence, starvation, and depression of mind, to a condition of succumbing to any epidemic influence which may be prevalent at the time. The abomination must end!

We have adverted to the mental depression of these poor children as conducing to disease; and it has often occurred to us as strange that an influence of such fatality should be so little recognised by the guardians of the poor. There are many individuals who, although horror-stricken at the bare notion of affording insufficient aliment to such as might in any way be dependent on them, would not hesitate to commit on the same any variety of injustice of sentiment. Let not the term be sneered at: such an injustice is most painful of all. Surely if a woman may die because her chastity is suspected, or a soldier because he has been unjustly called a poltroon, a sentimental injury is a very powerful one; and, until it can be shown that pauper boys and girls are really not a portion of the great family of Adam and Eve, punishments so insulting to humanity as those recorded to have been practised at Tooting must be recognised amongst the many depressing influences which break down the barrier of health.

The friends of the Tooting child-farmer need not mourn over any impending legal fate which may await him. The legal appreciation of his deserts in high quarters is significant enough. "I may remark," said the learned coroner, in his address to the jury:—

"That although Mr. Drouet, who was charged with manslaughter, had been liberated on bail by Mr. Justice Erle, the same learned judge had refused to accept bail on Friday in the case of the 'Queen v. Warren and Fuller,' where the defendants were charged with felony, on the prosecution of the Goldsmiths' Company, in having transferred the assay marks of that company."

But this was an attack against property; and *property has its rights!*

MISCELLANEA.

CHEMICAL PATENTS RECENTLY ENROLLED.

Chevalier Alexandre Edouard Lemolt, of Conduit-street, Middlesex, for certain improvements in apparatus for lighting by electricity, parts of which may be made use of in other applications of electricity. Patent dated July 20th, 1848. Enrolled January 20th, 1849.

This invention relates to improvements in electric piles, which consist in the use and application of a new element in electric piles and other appliances connected therewith; secondly, the application of two discs of carbon as electrodes, for the purpose of producing an electric light, which discs are caused to approach each other by suitable mechanism, so as to maintain the same relative distance between the peripheries, in order to obtain a continuous light.

First, with regard to the new elements for the production of electricity, it is well known in the manufacture of gas, by the destructive distillation of coal, that a hard carbonaceous deposit takes place on the interior of the retort; this it is only necessary to remove, and cut or shape it in suitable plates of which to compose the battery, it not being necessary that this carbonaceous deposit should undergo any further operation. The plates of carbon are suspended within two porous jars, which again are enclosed by cylinders of amalgamated zinc. The plate of the one jar is put in connection with the zinc cylinder of the other by strips of metal, and, in order to render the attachments thereof permanent, the patentee electrotypes the ends of the plates with copper, or some such metal as will admit of securing the straps by solder, while at the same time the opposite ends are similiarly attached to the amalgamated zinc cylinders, and further secured by riveting, thereby preventing the possibility of

any of the series becoming detached while the battery is in operation; the whole are enclosed in a suitable carthenware jar, for the purpose of containing the aeid: when the batteries are intended for removal these jars are furnished with a return lip, which prevents the aeid being thrown out. The patentee uses nitric acid for the innor or porous jar, while in the outer jar dilute sulphuric acid (about seven parts water to one of acid) is placed. The action of this description of apparatus is so generally understood as to render further description useless. Instead of cutting the plates of earbon from the mass, as before mentioned, the patentee prepares them by combining other matters with it, in which case this earbonaeeous matter must be in a comminuted state. To three parts thereof, by weight, the patentee adds one part of pounded coal, coke, or ehareoal, together with one part of eoal-tar; these are to be intimately mixed, when they will be of such a eonsisteney as to be readily eapable of being formed into the requisite shapes for the plates or earbon elements in suitable moulds, in which they are to be compressed by means of an hydraulic or other press calculated to produce the requisite degree of pressure; by this means they will be redueed to a hard compact state. The plates or blocks so formed are then removed from the moulds and exposed to the atmosphere in the shade, for two or three days, to evaporate the moisture; they are now to be subjected to heat for about thirty-six hours, and their temperature is gradually raised to a light red heat, when they are allowed to cool as gradually as they were heated; they may then be applicd as an element in electric piles, the one end being eleetrotyped as before explained, for the purpose of effecting the permanent metallic connection.

Another part of this invention refers to the coating of one side of the zinc plates, or the amalgamated eylinder of zine, whieh has no relative influence with the earbon plates, and consequently, if left exposed to the aeid, will bc uselessly destroyed. In this case the outside of the cylinder is eovered with a coating of eopal varnish, and, in order to give it a body, it is mixed with eharcoal or eoal dust, but other matters may be used for the purpose.

The last part has referenee to the production of electric light for the purposes of illuminating, by the application of two discs of carbon, in which a revolving motion is maintained by suitable apparatus, so arranged that their peripheries shall retain the same degree of proximity, thereby produeing an uninterrupted light for a eonsiderable length of time. For this purpose the electrodes should be of the purest carbon, to obtain which the patentee immerses them in a solution of nitric and muriatie aeids for about twelve hours, and afterwards in a solution of fluoric acid, whieh will remove in a great measure the impurities eontained.

Having described the nature of his invention, and the manner of carrying the same into effect, he wishes it to be understood that he does not confine himself to the detail given, so long as the peculiar eharaeter of either part of the invention be retained; but what he elaims is:—

First, the application of that description or quality of earbon obtained in the destruetive distillation of coal and other matters such as are used in the manufacture of carburetted hydrogen gas, as one of the elements of an eleetric pile, and also the employment of earbon, moulded and subjected to pressure, and manufaetured as described. Also the elcetrotyping the ends of carbon used as elements in eleetric piles. Also the connecting of carbon elements of an electrie pile with other elements used, by soldering or by any other permanent fixture.

Secondly, the applieation of two discs of earbon as electrodes, that they shall (when they have completed a revolution) be caused by the mechanism to approaeh eaeh other, and by that means obtain a continuous light of electrieity.

Joseph Stenson, of Northampton, engineer, for improvements in steam engines and boilers, part of which improvements are also applicable to other motive maehinery. Patent dated July 18th, 1848. Enrolled January 18th, 1849.

This specifieation relates to a variety of improvements in steam maehinery, steam-boilers applieable to steam-engines, and to eertain apparatus for eooking; an improved self-acting damper for high-pressure boilers; a method of heating the feed-water of condensing engines, and an improved system of eondensing the exhaust steam from the cylinders; for various other improvements in steam-engines; and for obtaining an electric light from steam, &c. &c., embracing no less than fifteen distinet claims. Of these claims we will, however, here simply give the heads. He elaims:—

First. An improved construction of a rotary engine.

Seeondly. An improved form of that class of engine known by the name of rotary emission engine. The improvements consist in using two wheels, the peripheries of whieh are made hollow, and pierced on one side with a suitable number of oblique holes for the emission of the steam; one of these wheels is keyed to a hollow shaft, supported at either end in bearings; while the second wheel is fixed from lateral motion, but allowed to revolve freely on the shaft, and near to the first-mentioned wheel; the oblique openings in the inner sides of the peripherics of the wheels are slanted in opposite direetions, and plaeed at different points of the eircle. The inner faces of the peripheries are also indented after the manner of an ordinary overshot water-wheel. When steam is admitted through the hollow shaft it passes through holes into the hollow central bosses of the emission-wheels, and from thence through a suitable number of radiating arms, into the hollow peripheries. By this arrangement, as the steam issues forth, it will impinge upon the buckets or indents of the neighbouring wheel; each one thus becoming a fulcrum for the other to act against. A mueh greater power will thus be obtained with the same pressure of stream than by any other system now in use; motion may be conveyed from the hollow shaft by means of a bevilled wheel and pinion, or by bands,—one passing round a pulley on the shaft, and the other round the hub of one of the emission-wheels; but, as the wheels revolve in opposite direetions, one band must be passed to the point of communication straight, and the other crossed.

Thirdly. An improved form of eommunication in oscillating steam-cylinders. Between the piston-rod and crank an upright bar is bolted on each side of the top of the cylinder-cover, and connected by a cross bar at the top; to the end of the piston-rod is affixed a eross head, which slides in grooves made for its reception on the inner sides of the upright guide-bars. By this arrangement the crank-pin may be connected immediately with the upper end of the piston-rod, thus avoiding the necessity of the ordinary conneeting-rod, and also the use of long stuffing-boxes, the vertical motion of the piston-rod from the cylinder being effectually retained by the guide-bars, as deseribed.

The fourth part relates to a great variety of forms for boilers given in the drawings accompanying the speeifieation, the object being to procure a greater amount of heating and flue surfaee, for the generation of steam, than by the forms commonly used.

Fifthly. The patentee elaims the invention of an approved self-acting damper for the use of high-pressure boilers.

The remaining elaims are:—

Sixthly. For an improved method of heating the feed water of condensing engines.

Seventhly. For aeeelerating the condensation of exhaust steam from the cylinders of eondensing engines.

Eighthly. For the use of two boilers on locomotive engines.

Ninthly. For expanding and drying the steam in its passage from the boiler or boilers to the working cylinders of locomotive engines.

Tenthly. For an improved form of gauge-cocks.

Eleventhly. For strengthening steam-pipes, by the applieation of tension-rods.

Twelfthly. For an improved boiler for cooking apparatus, with regard to the use of an emission whcel or wheels, and all the parts immediately connceted with and dependent thereon.

Thirteenthly. For the adaptation of steam-engines for thrashing, and other agricultural purposes, from a distance.

Fourteenthly, For dispensing with the use of the air-pump in the case of eondensing engines, or at least reducing it very much in size compared to those now in use.

Fifteenthly and lastly. For obtaining electricity for an electric light from steam. To a jet of steam issuing from the orifices of an emission-wheel the patentee applies a copper or other metallic wire, from which a number of small pointed arms or spokes radiate; the wire thus beeomes highly eharged with eleetricity. The charge is earried by the wire through two electrodes of chareoal to some part of the metallic framing of the engine, and from thence to the earth, thus forming an eleetrie circuit. The bottom electrode is of a cylindrieal form, the upper edge of which is presented towards the upper eleetrode. A slow revolving motion is given to the lower electrode by means of suitable whcelwork from the working part of the engine, thus dispensing with the use of batteries, whose aetion is so diffieult to maintain, and which have always been supposed to be essentially necessary for the production of an electric light.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING JANUARY 25TH, 1849.

William Boggett, of St. Martin's-lane, Middlesex, manufacturer, for improvements in methods and machinery for obtaining and applying motive power. Patent dated January 20th, 1849; six months.

Henry Bernoulli Barlow, of Manchester, consulting engineer, for improvements in the manufaeture of cut piled fabries, and in machinery or apparatus applieable thereto. Patent dated January 20th, 1849; six months. (Communication.)

Samuel Brown, the younger, of Lambeth, Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids, and of substances in a running state, whieh apparatus arc in part also applicable to motive purposes. Patent dated January 20th, 1849; six months.

Henry Needham, of Vine-street, Piccadily, in the city of Westminster, gunmaker, for certain improvements in firearms. Patent dated January 20th, 1849; six months.

Thomas Robinson, of Leeds, flax-dresser, for improvements in maehinery for breaking, scutehing, eutting, heckling, dressing, combing, earding, drawing, roving, and spinning flax, hemp, tow, wool, silk, and other fibrous substanees, and in uniting fibrous substanecs. Patent dated January 23d, 1849; six months.

Charles de Berguc, of Arthur-street West, in the eity of London, engineer, for improvements in steam-engines, in pumps, and in springs for railway and other purposes. Patent dated January 23d, 1849; six months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam-engines. Patent dated January 23d, 1849; six months.

Rees Reeee, of London, chemist, for improvements in treating peat, and obtaining produets therefrom. Patent dated January 23d, 1849; six months.

Charles Henri Paris, of Paris, in the Republic of France, for improvements in preventing the oxidating of iron. Patent dated January 23d, 1849; six months. (Communication.)

William Henry Barlow, of Derby, civil engineer, for improvements in the construction of

permanent ways for railways. Patent dated January 23d, 1849; six months.

Richard Johnson, of Blackburn, in the county of Lancaster, gentleman, for certain improvements in the manufacture of malted grain, and in vinous fermentation; also improvements in brewing, and in the machinery or apparatus connected with the above or similar processes. Patent dated January 23d, 1849; six months.

Wakefield Pim, of the borough of Kingston-upon-Hull, engine and boiler maker, for certain improvements in propelling ships and vessels. Patent dated January 25th, 1849; six months.

Robert Shaw, of Portlaw, in the county of Waterford, cotton-spinner, and Samuel Fletcher Cottam, of Manchester, machinist, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Patent dated January 25th, 1849; six months.

John Talbot Tyler, of the firm of Ashmead and Tyler, Mount-street, Grosvenor-square, hatters, for certain improvements in hats, caps, and hat-cases. Patent dated January 25th, 1849; six months.

A RETURN OF PATENTS FOR INVENTIONS TAKEN OUT IN IRELAND FROM THE 20TH DAY OF NOVEMBER, 1848, TO THE 20TH DAY OF JANUARY, 1849, INCLUSIVE.

Joseph Eugene Asaert, of Lille, in the Republic of France, machinist, for improved means of obtaining motive power. Sealed November 22d, 1848.

Pierre Frederic Gougy, of Leicester-square, in the county of Middlesex, gentleman, for improvements in apparatus and machinery for raising, lifting, and otherwise moving heavy bodies. Sealed November 30th, 1848.

Alfred Vincent Newton, of Chancery-lane, in the county of Middlesex, mechanical draughtsman, for certain improvements in the manufacture of steel. Sealed December 2d, 1848.—(Communication.)

Joseph Lillie, of Manchester, in the county of Lancaster, engineer, for certain machinery or apparatus applicable for purifying and cooling liquids, and for purifying, condensing, and cooling gases. Sealed December 5th, 1848.

Hugh Bell, of London, esquire, for certain improvements in aërial machines, and machinery in connection with the buoyant power produced by gaseous matters. Sealed December 9th, 1848.

Duncan Mackenzie, of Goodman's-fields, in the county of Middlesex, manufacturer, for certain improvements in jacquard machinery for figuring fabrics and tissues generally, and apparatus for the transmission of designs to the said jacquard machinery, parts of which are applicable to playing musical instruments, composing printing types, and other like purposes. Sealed December 22d, 1848.—(Communication.)

Bartholomew Beniowski, of Bow-street, Covent-garden, in the county of Middlesex, major in the late Polish army, for certain improvements in the apparatus for, and process of, printing. Sealed January 3d, 1849.

Joseph Simpson, of the city of Manchester, civil engineer, and James Alfred Shipton, of the same place, engineer, for certain improvements in steam-engines. Sealed January 5th, 1849.

Charles Green, of Birmingham, in the county of Warwick, patent brass tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of a part or parts of railway wheels. Sealed January 5th, 1849.

Carey M'Clellan, of Larch Mount, in the liberties of the city of Londonderry, for an improved corn-mill. Sealed January 10th, 1849.

William Edwards Staite, of Lombard-street, in the city of London, gentleman, for certain improvements in lighting and in the apparatus used therein, parts of which are applicable to other useful purposes. Sealed January 12th, 1849.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery or apparatus for winding, balling, or spooling thread, yarn, or other fibrous materials. Sealed January 12th, 1849.

PATENTS RECENTLY EXPIRED.

J. Streets and T. Whiteley, mechanics, of Nottingham, for certain improvements applicable to that class of machinery commonly called or known by the name of "warp machinery," employed in the manufacture of lace and other fabrics. Patent dated January 22d, 1835; expired January 22d, 1849.

J. J. Tucker, of Cornwall, esquire, for certain improvements in urns to be used for tea, coffee, and other purposes. Patent dated January 22d, 1835; expired January 22d, 1849.

J. Day, of Peckham, gentleman, for an improvement or improvements in the construction of railways. Patent dated January 22d, 1835; expired January 22d, 1849.

W. E. Wright, of Westminster, gentleman, for certain improvements in tea and coffee urns, and tea kettles. Patent dated January 27th, 1835; expired January 27th, 1849.

J. Gibbs, of Kennington, and J. Catley, of Whitechapel, engineer, for certain improvements in machinery for cutting wood and other materials. Patent dated January 27th, 1835; expired January 27th, 1849.

W. Morgan, of Surrey, esquire, for certain improvements in steam-engines. Patent dated January 27th, 1835; expired January 27th, 1849.

J. Budd, of Liverpool, merchant, for a certain improvement, or certain improvements, in printing silk, cotton, calico, or other fabrics, and in the manufacture of blocks, cylinders, or rollers used for such purposes. Patent dated January 27th, 1835; expired January 27th, 1849.

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON JAN. 31, 1849 :—				
In London and vicinity, viz. :—				
Kensington	5	2		
Emigrant Depôt at Deptford	2			
Whitechapel	1			
St. George-in-the-East	1			
Lambeth-walk	1			
High-hill Ferry, Clapton	1			
Hackney	1			
In the country, viz. :—				
Liverpool	2	1		
Newcastle-upon-Tyne	2	1		
Thames Ditton	1	1		
In Scotland, viz. :—				
Edinburgh	4	1	3	
Glasgow	23	4	2	
Riccarton	8	2	3	
Selkirk	2			
Loudon	2	5		
Millerhill, Dalkeith	5	1		
Old Monkland	29	18	8	
Greenock	6	2	2	
New Kilpatrick	12	4	2	
Dundonald	2			
Total new cases	106	42	20	
In London and vicinity	884	479	131	274
In the country	764	328	96	340
In Scotland	8547	3705	2345	2497
Total	10195	4512	2572	3111

THE BILLS OF MORTALITY.

The returns of the Registrar-General for the week ending Jan. 27 show the total number of births to be 1,576, and the deaths 1,208, the latter being an increase of 39 on the weekly average of five winters. This result is more favourable than that obtained in the two previous weeks, when the deaths were respectively 1,448 and 1,345. The return shows that the deaths from zymotic diseases were 329, being 108 above the average; from dropsy, cancer, and other diseases of uncertain or variable seat, 54, being the usual average; from tubercular diseases, 175, being 28 below the average; from diseases of the brain, spinal marrow, nerves, and senses, 150, being 9 above the average; from diseases of the heart and bloodvessels, 22, being 18 below the average; from diseases of the lungs and of the other organs of respiration, 245, being 2 above the average; from diseases of the stomach, liver, and other organs of digestion, 63, being 4 below the average; from diseases of the kidneys, &c., 14, being 1 below the average; from childbirth, diseases of the uterus, &c., 13, being 4 above the average; from rheumatism, diseases of the bones, joints, &c., 10, being 3 below the average; premature birth and debility, 16, being 7 below the average; atrophy, 20, being 5 above the average; age, 45, being 28 below the average; sudden, 8, being 6 below the average; violence, privation, cold, and intemperance, 23, being 14 below the average; smallpox, 16, being 5 below the average; measles, 18, being 9 below the average; scarlatina, 76, being 44 above the average; hooping-cough, 55, being 13 above the average; diarrhœa, 17, being 5 above the average; dysentery, 5, being 3 above the average. The number of deaths from cholera is stated to be 45; and of these 14 occurred in the district of Wandsworth and Clapham, 2 of them being in the institution at Tooting. The total number of deaths in this house, or among the children who have been removed from it, registered in four weeks, amounts to 188, of which 158 were returned as caused by cholera. The rest are ascribed to dysentery, mesenteric diseases, &c. During the week 56 people have died from typhus, being 14 above the average; from bronchitis, 104, being 26 above the average; from pneumonia, 95, being 8 below the average; from asthma, 26, being 12 below the average. The Registrar-General adverts to the fact, that the deaths from diseases affecting the respiratory organs were 245, almost the same as the average, having declined from 325 and 300, the numbers of the two former weeks, while the mean daily temperature ranged from 24°6 on the 2d day of the month to 49°6 on the 25th. In the last week a boy was registered in the Kent-road sub-district who died of "natural causes accelerated by exposure to cold;" and at Clapham a woman of 18 who died of "peritonitis, brought on by exposure to cold and damp," after seven days' illness. Inquests were held in both cases. A woman and her child died in Leather-market, Bermondsey, of "diarrhœa from want of sufficient nourishment," as certified by medical certificates. The former was seven months advanced in pregnancy. It does not appear that an inquest was held in either of these cases. The medical man adds, that the house was in a most offensive condition from want of drainage.

The following is a detailed statement of the fatal cases of cholera, all certified by medical attendants except two:—

KENSINGTON; Town.—In the workhouse, F. 23, "typhoid fever, consecutive on cholera;" at Jenning's-buildings, widow of a labourer, 39, "cholera (19 hours);" at same buildings, daughter of a labourer, 5, "cholera (46 hours);" at same buildings, gardener labourer, 34, "cholera (13 hours)."

CHELSEA; South.—M. 65, "cholera (14 hours)," p.m.

WESTMINSTER; St. John.—At No. 27, Rochester-street, stoker at a gaswork, 45, "spasmodic cholera (7 hours)." Mr. Pearse, the registrar, states that "this man laboured under

severe diarrhœa during the night preceding the attack, and next day, while engaged at his work, was stripped to the skin, and exposed to extremes of temperature.".

St. Pancras; Tottenham.—At 30, Tavistock-square, F. servant, 29 "cholera (3 days)." Gray's-inn-lane.—At the Royal Free Hospital, F. 30, "cholera (3 days)." Camden-town.—At the workhouse, a girl who had been removed from Tooting, 7, "cholera."

Hackney; Stamford-hill. — At High-hill Ferry, F. 43, "cholera (2 days); typhus (5 days)." Mr. Montaigne, the registrar, states that "the deceased was the wife of a poor labouring man, with five children, and occupied a miserable house of only two rooms; the lower so damp and uncomfortable that they could not inhabit it. The whole family slept in the upper one, without bed or bedstead. Three of the children now lie ill; and, with regard to two, I am informed by the surgeon that there is little hope of their recovery. Another case of cholera has shown itself in a house a few doors from the above. High-hill Ferry is very damp, and the houses are so crowded that many of them have no back yard,"

Holborn; St. Andrew, East.—All the cases in this sub-district occurred in the union workhouse. F. 22, "cholera (6 hours);" M. 12, "cholera Asiatica (13 hours)," relapse; M. 51, "Asiatic cholera (33 hours);" M. 2, "Asiatic cholera (12 hours);" F. 40, "cholera (15 hours);" F. 60, "cholera;" M. 71, "Asiatic cholera (21 hours);" F. 38, "cholera (2 days); consecutive fever (3 days);" F. 28, "cholera (2 days);" M. 16, "Asiatic cholera (9 hours);" F. 40, "cholera (21 hours);" F. 40, "Asiatic cholera (16 hours);" F. 22, "Asiatic cholera (22 hours)."

Bethnal-green; Hackney-road. — Toy-maker, 55, "cholera (22 hours)."

Whitechapel; Spitalfields.—F. 25, "Asiatic cholera (7 days)." Goodman's-fields.—At 88, Leman-street, a labourer, 48, "Asiatic cholera."

St. Saviour; St. Saviour.—M. 57, "Asiatic cholera (14 hours)."

Bermondsey; St. James. — M. 7, "Asiatic cholera (12 hours)." No medical attendant. M. 13 months, "diarrhœa (some days), Asiatic cholera (24 hours)."

St. George, Southwark; Kent-road.—At 9, Crown-yard, daughter of a waterman, 5, "Asiatic cholera (24 hours)."

Lambeth; Church, First Part.—F. 2, "cholera spasmodica (2 days)."

Wandsworth and Clapham; Wandsworth.—M. 8, "epidemic cholera (4 days)." F. 4, "cholera (8 hours)." F. 24, "pneumonia (3 weeks); debility after cholera (5 weeks)." F. 80, "Asiatic cholera (14 days); exhaustion." M. 28, "diarrhœa (14 days); Asiatic cholera (17 hours)." F. 31, "cholera (7 days); exhaustion; miscarriage." F. 5, "Asiatic cholera." F. 34, "Asiatic cholera (4 days)." F. 9, "malignant cholera (25 hours)." F. 40, "cholera (18 hours)." Streatham and Tooting Graveney: In Drouet's establishment, M. 4, "cholera (13 hours)." In same establishment, F. 9, "cholera (3 hours)." Besides the above, the following deaths from other causes in this establishment were registered in the week:—F. 6, "mesenteric disease; debility (4 weeks)." M. 9, "dysentery (3 weeks); debility." M. 4, "mesenteric disease (3 weeks); debility." Battersea.—In Ann-street, York-road, wife of an engineer, 36, "malignant cholera (12 hours)." In Church-street, single woman, 32, "Asiatic cholera (7 hours)."

Indestructibility of Cork.—In taking down a few years ago, in France, some portion of the ancient chateau of the Roque d'Ondres, it was found that the extremities of the oak girders, lodged in the walls, were perfectly preserved, although these timbers were supposed to have been in their places for upwards of 600 years. The whole of these extremities buried in the walls were completely wrapped round with plates of cork. When demolishing an ancient Benedictine church at Bayonne it was found that the whole of the fir girders were entirely worm-eaten and rotten, with the exception, however, of the bearings, which, as in the case above mentioned, were also completely wrapped round with plates of cork. The fixings were completed by a layer of greasy-feeling clay, interposed between the cork and the masonry, and the parts of the walls opposite the ends of the timbers were of brick. It would be very difficult to believe that these extraordinary instances of the preservation of timber were not to be entirely attributed to the cork plates, the impermeability of which is well known, since the substance is not only used to contain different kinds of liquids, but also to close bottles containing spirituous liquors. With experience saying so much in favour of a process so simple and inexpensive, it must be acknowledged that it deserves to be tried, more particularly for buildings of which we are more than usually anxious to preserve the timbers.—*Artisan*.

Earthquakes in the Azores.—The following is an extract of a letter dated St. Michael's, Dec. 3:—"For ourselves, we are, thank God, as well as we can be, considering the fright we have been living in for the last month, not from revolutions on the surface, like the rest of the world, for ours are internal, occasioning most fearful earthquakes. We felt seven in one night, and a great many since. One, on the night of the 4th of November, was so violent that we all got up, and many people ran into the streets, although it was raining violently. For several nights we moved our beds to the ground floor, the concussions being felt much more up stairs. To increase the general consternation, one night a most brilliant aurora borealis appeared at the west end of the island—a thing quite unknown in these latitudes. The earthquakes were much worse, many houses and part of a church being thrown down. We have since learned that the city of Angra, in Terceira, is nearly destroyed, and that such of the inhabitants as are able to do so are leaving the island."

The Arctic Expedition.—News has been received at the Admiralty from Captain Kellett, of the Herald, confirming the report of his not having fallen in with the Plover, which ship was bound in search of the missing expedition; and so far the Herald had failed in her desired object: but it was hardly under any circumstances to have been expected that the Herald with her instructions could herself have fallen in with Sir John Franklin's expedition.

Seidlitz Powders.—Take 2 drachms of potassio-tartrate of soda and 2 scruples of sesquicarbonate of soda. Mix, and dissolve in half a pint of soft water. Then dissolve 35 grains of tartaric acid in q.s. of water, and add this to the former solution. It must be drunk in a state of effervescence. It is a mild cooling purgative, but does not in the least resemble the genuine seidlitz-water.

TO CORRESPONDENTS.

"W. H. Potter."—Presuming that you have (being engaged in analysis) the last English translation of Rose, we need not enter upon the analysis *in extenso*, for which, indeed, we have not space. The operation may best be commenced by separating the oxide of iron by Herschel's method as adopted by Berzelius (p. 443, vol. ii., Rose), afterwards proceeding as indicated at p. 437-8 of the same volume.

"G. B.," who sends us the following letter, embodying a good suggestion, and awarding us some praise, is thanked for his communication, and is assured that we will speedily profit by his advice in "Our Own Series":—"I felt great pleasure in reading Möhr and Redwood's 'Practical Pharmacy,' which you reviewed in the *Chemical Times* of Jan. 13, which contained useful information to the apprentice; but I should say not at all to the members of the Pharmaceutical Society. We are led to expect from the title of the work, 'Practical Pharmacy,' a work of practical nature, containing the more valuable preparations of the Pharmacopœia, with illustrations of apparatus and description. Now, it is no such thing: it is a work of no use to the practical chemist. I would suggest to the *Chemical Times* that the editor should give one or two preparations of the Pharmacopœia weekly, with illustration of apparatus and description. The London College says:—Hyd. nit. oxyd.—'Take of mercury, nitric acid, water, &c. &c.; mix them in a proper vessel.' Now, sir, what is a proper vessel? Illustrate the vessel and description. 'Then boil down the liquor, &c. &c., then put into another very shallow vessel.' A shallow vessel of what—iron, tin, copper, or delph? Hyd. Bichlor.—'Take, &c., then sublime with a heat gradually raised.' Now, a description of the apparatus for subliming, with an illustration, would assist the pharmaceutist in practical pharmacy as a text on which his inventive talent might improve for the better preparing the preparations of the Pharmacopœias. My anxiety for information and for the welfare of the *Chemical Times*, which is now so ably conducted, must be my apology for thus troubling you."

"Mr. P. Horton."—It is true the proto-acetate of mercury is somewhat insoluble, but not sufficiently so for enabling the acid to be precipitated from a solution containing it.

"N. P. O." asks us whether it is true that a certain graveyard sculptor, who has contributed so largely to the monumental triumphs of Kensal-green, did not engage in some scheme for making gold. We have heard so, on pretty good authority; and the scheme is not more ridiculous than his other scheme of inverting all artillery practice, and shooting 68-pound cannons at the enemy in place of 68-pound shot.

"Mr. Charles Sawyer."—Hydriodic acid is much more easily decomposed than hydrochloric and hydrobromic acid gases, by substances which have an affinity for hydrogen; also when treated with certain metals, mercury for instance, which combine with the iodine and disengage hydrogen gas.

"Mr. Nicoll."—We beg to assure you of our desire on all occasions to conduce to your convenience, welfare, and happiness. Your remarks are always viewed in the best spirit, and receive our deepest consideration.

"An Assayer" will do very wrong, in our opinion, by attempting to use the blowpipe as a quantitative instrument. It does not follow that because a thing can be done it is always desirable to do it. Paganini could play on one string, but he could play still better on four.

"Mr. N. Barrow."—The chlorates when heated disengage oxygen like the nitrates, but at a less elevated temperature.

"Toxicologicus" writes to us, stating that he has seen it mentioned that a mixture of iodic acid and starch is a test for sulphuric acid; and asks whether, by an error of the press, sulphurous acid is not meant. We do not conceive there is an error of the press, but a reprehensible looseness of diction. Directly, it is true, the iodic acid mixture is a test for sulphurous acid, but indirectly of sulphuric acid. Thus, if a mixture of sulphuric acid with organic matters, say the ordinary contents of a stomach, be exposed to a sufficient heat in a retort, the beak of the retort plunged into a mixture of iodic acid and starch, the latter will assume a blue tint, because of the passage of sulphurous acid gas. Hence the chain of reasoning is as follows:—Because the colour of the mixture is blue, owing to the deoxidation of iodic acid and the liberation of pure iodine, sulphurous acid (it is inferred) has passed, which could only have been developed, it is inferred by the action of carbonaceous matters on sulphuric acid. Hence the latter may be said to have been tested by the mixture adverted to. The experiment is very elegant, but alone not irrefragable as to the presence of sulphuric acid.

"Mr. Robertson, Kennington."—The composition of the article in question is a secret.

"Mr. H. Horton."—It is said that cod liver oil can be distinguished from other animal oils impregnated with iodine by adding sulphuric acid, which develops a purple colour, passing to brick-red in the former but not in the latter. We have no faith in the test.

"Mr. N. Bickersteth."—We are informed that the Messrs. Drew and Hayward have succeeded in manufacturing isinglass of superior quality from cod sounds, which they are able to offer to the public at a very moderate price. The process we do not know.

"Mr. H. Stevens, Liverpool."—We believe that the use of matico as a styptic and astringent is greatly on the increase. We know that there now is considerable difficulty experienced in Peru to execute orders.

A medical correspondent complains of the injustice perpetrated by insurance companies in obtaining medical certificates, often of a delicate and most confidential nature, without tendering a fee. We are happy to say that many of the respectable insurance companies do not follow this plan. Of these the Royal Farmers' and General Fire, Life, and Hail Assurance Institution is one.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—February 3, 1849.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

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[*Continued from page* 155.]

THE OPERATION OF REFINING.

The term sugar refining is applied, as is well known, to the operation, or series of operations, by means of which the dark impurities are extracted or separated from white sugar, and the latter is isolated.

Hence the terms, white sugar and refined sugar, have grown to be synonymous; and the idea has been created that white sugar must necessarily be the product of a second operation. This notion is most fallacious; and not more fallacious than injurious; by causing the impression that no such body as white sugar could be primarily extracted from the cane, or other sugar-containing juices.

Very frequently do we hear the colonial sugar-growers subjected to many and adverse remarks, because they have not, as it has been asserted, developed their art with the rapidity that modern scientific aids would have enabled them to do.

Much of this animadversion is unjust, for not only until the passing of Sir Robert Peel's Sugar Bill, in 1843, was the colonial sugar-producer not encouraged to make a product beyond a certain limit of goodness, but he was not permitted to do so; every step he took in this direction being checked by a high protective duty, with the object of favouring the home refineries.

Immediately the sugar duties were readjusted, the intelligent colonial sugar-growers availed themselves of the opportunity to improve their staple; but, unfortunately, they began with machinery instead of chemistry. They relied on improved means of boiling, not having yet procured the proper liquid to be boiled. Whilst their new experiments were being prosecuted,—whilst they were bearing most stoically their present losses, and looking forward to a brighter future,—England became deluged with finer sugars of Cuba and Brazil, made by the claying operation. The West India sugar-grower was undersold, and too frequently ruined. Often do we hear the question put—wherefore the West India sugar-grower does not practise the claying process? The question manifests little acquaintance with the subject at issue. The process of claying, be it remembered, is not indicative of an improved sugar manufacture, as is commonly supposed; but merely indicative of the fact that, at the expense of time, of labour, and a third of the material operated on, it has been deemed expedient to accomplish the washing out a certain amount of impurities from muscovado sugar. These facts being well considered as premises, the conclusion may very safely be arrived at that the claying operation can only be remuneratively practised under one of the following conditions:—either in communities where slavery prevails, or where the price of labour (as in India) falls under the usual average.

But to return to the subject of sugar refining.

In commencing the study of this manufacturing operation it will be useful to consider the theoretical indications to be followed out.

The substance to be operated upon is raw sugar; and the object to be kept in view is—to extract the maximum of impurities, with the minimum of expense and of loss.

If muscovado or yellow sugar were contaminated by chemical or soluble impurities only the process of claying or liquoring would effectually remove them. This, however, is far from being the case. If a portion of the purest colonial sugar (made without animal charcoal) be dissolved in water, the presence of mechanical or floating impurities will be very manifest. Such impurities must be got rid of at any cost before the sugar can be refined. The most obvious way of accomplishing this removal would seem to consist in mechanical filtration through fibrous textures, followed by evaporation; and this succeeded by the process of claying and liquoring.

It happens, however, that even were this process the most desirable, as well as the most obvious, yet the filtration of such sugar in thick solution is no very easy matter, on account of the glutinous nature of the chemical-coloured impurities, as the experimenter may prove by means of a filter of paper; however, by allowing sufficient time, the thing, as an experiment, may be done; and I will suppose it done for the sake of the next demonstration.

The liquor, when so filtered, if placed between the eye and a ray of light, will be found to be entirely free from the mechanical impurities formerly visible, but will be as dark, from the presence of chemical impurities, as before filtration. The indication, therefore, is obviously to reduce those chemical impurities, by means of some combination, to a mechanical or filtrable condition. The usual agent employed for this purpose in refineries is an aqueous solution of lime, that is, lime-water.

If a portion of the dark filtered solution be mixed with a portion of lime-water in a test-tube, and heated by a spirit-lamp flame, a manifest change will be observed; a portion of the soluble impurities will be found to become insoluble, assuming the condition of brownish flakes; and rendering the solution turbid.

The liquor now will be found to pass much more readily through a paper filter than before; and, moreover, will have been considerably lightened as to colour.

If the filtration process be conducted with less care, the liquor, as it passes through, will be contaminated with a portion of the separated impurities, which, in point of fact, are so delicate in their physical nature that the slightest force breaks them up and partially redissolves them—a circumstance which, as may be imagined, would materially impede the filtering operation on a large scale. However, for the purpose of demonstration, it can be, and sometimes is, accomplished.

If a little white of egg and lime-water be mixed with a portion of the solution while cold, and the mixture be now heated in another test-tube, the same kind of result will be accomplished as in the last experiment, but with this addition:—the albumen of the white of egg, or the blood during coagulation, envelops each floating particle of the mechanical impurity developed by the agency of lime, and brings it to the surface of the liquor in the form of scum, leaving the subnatant fluid clear and bright.

If the result of the last experiment be filtered, a fluid will come through,—red if blood has been employed, yellowish or amber if the white of egg. Either of these solutions on being evaporated evolves an animal smell, and eventually yields crystals, from which the non-crystalline portion may be drained, and the crystals rendered white, by the process of claying (real or virtual), either alone, or the latter succeeded by the process of liquoring.

If, instead of evaporating the liquid immediately after passing through the filter, it be made to percolate through granular boneblack, the result is marvellously improved. Every trace of colour is dissipated, and the liquor feels less glutinous to the touch: it has acquired also (owing to the removal of impurities) an increased facility of crystallization. The smell of the animal matter, however, generally remains.

Having gone through these preliminaries, we are now in a position to contemplate the process of refining, as now prosecuted.

A good refinery should consist of not less than four floors; if more, all the better. Its walls should be strong, its planks well seasoned, and close; and steam-pipes should be laid on throughout, so that a temperature of 80° can be easily commanded everywhere except on the ground floor or fill-house, the bastard curing-room, and the stove, the former of which will require a temperature of 120°, and the latter of 112° to 115° F.

Through the middle of each floor is a large square hole, capable of being shut by means of a trapdoor, and through which the sugar is pulled from the lowest floor to the highest, by means of a gin or small crane.

This is the best arrangement for a refinery, although the details of arrangement may vary considerably. The conditions which I have laid down are adapted to the supposition that the sugar is dissolved on the highest floor, and that it is subsequently worked down to the lowest, where, having been boiled, it is filled into moulds. These conditions are the most natural and the most rational; but they are sometimes violated; the sugar being dissolved on one of the lower floors, and, subsequently, lifted again. By this latter method of procedure the height of a floor or story can be saved; but the operation of pumping is usually involved,—an operation which is never to be recommended.*

Another floor or story in refineries is frequently saved by a less objectionable plan; the liquor prepared for boiling being discharged on the ground-floor, and sucked up into the vacuum-pan on the second.

Wherever in a refinery the process be commenced, the first operation consists in effecting the solution of sugar in such a mixture of water, lime-water, and blood,—technically called spice,—that the resulting liquor, at the temperature of 212° F., shall have a specific gravity by preference of about 1,241, equivalent to 28° of Beaumé's saccharometer. This operation, which is called blowing up, is thus performed.

The blow-up pan is a square or rectangular painted iron, or, much better, plain copper, tank—supplied with a perforated false bottom, under which is laid horizontally a three-armed tubular perforated pipe of copper, in connection with a steam main. The use of this arrangement will be presently obvious. The sugar being put into the pan along with the predetermined quantity of blood, lime-water, and water—the quantities of each being adjusted by no fixed rule—the blow-up man lets on his current of steam, which, penetrating into the arms of the trifid horizontal pipe, emerges in sharp jets through the small apertures of the latter, and heats the contents of the blow-up pan with great rapidity to the boiling temperature. For this blow-up operation some houses use high-pressure steam, some low pressure. There is now a prevailing opinion in favour of the latter, in consequence of a belief that high-pressure steam is destructive of sugar.

The result of boiling the contents of the blow-up pan will have been anticipated from a consideration of the experiment I have supposed to have been performed in a test-tube; a thick, bulky, offensive scum arises to the surface of the liquid, which might be skimmed off with tolerable facility, and the subnatant liquor left in a state approaching to mechanical purity. This skimming, however, is never practised in the present day, filtration being had recourse to, as a much more efficacious plan.

The process of filtration now universally adopted is the bag filtration system, as it is called; and which offers the advantage of a very large surface, comprehended within a very small space.

The bag filter consists of a sack of about 5½ feet long, made of twilled cotton, prepared for this specific use. When to be employed it is used as follows:—The bag itself, which is about two feet broad, is squeezed loosely into a smaller bag (open at the bottom) made of very coarse material, and technically known as the sheath. By this arrangement the whole filtering area of the bag is effective, although it is made to occupy very small dimensions. Each bag, with its accompanying sheath, is tied by the following device to a brass nozzle, slightly expanding at one end, to which the bag is affixed, and having a screw turned at the other

* Liquor can be raised by the pressure of steam much better than by the more common operation of pumping.

end. The mouth of the bag, along with its sheath, having been brought well over the bell of the brass nozzle, is tied, sheath and all, moderately tight by means of strong cord. As it would be next to impossible, however, to whip the cord sufficiently tight to prevent the bag slipping off, on a weight of sugar being poured into it, the following plan of tightening it is had recourse to. A small copper bar of about four inches in length, being pushed under the cord, is twisted round until the necessary degree of tightness has been effected. The bar is now kept in position, and the twist prevented from returning by means of a second turn of cord. Many of these bags, usually about thirty-six, are hung in one series, as will be presently described; of which series there must be two.

A cast-iron tray, perforated with the requisite number of screw-holes to correspond with the number of bell-nozzles, is made to form the upper part or roof of a wrought-iron chest, supplied with doors removable at pleasure, and rendered air-tight in their frames, during filtration, by means of tow and red lead made into a pad, which engineers call a gaskin.

At the inferior part of this chest are two exit-cocks; one supplied with a pipe that conducts the filtered fluid away, and the other, technically called the foul-liquor cock, through which a portion of the filtered liquor may be examined, from time to time.

One other orifice has to be mentioned;—it is for the purpose of admitting steam; in an atmosphere of which the filter bags are caused to remain during the whole period that filtration goes on. This is for the purpose of enabling the liquor to maintain its temperature—therefore to remain liquid, and hence to pass through readily.

The filter chest and its accessories having been thus described, the operation of bag filtration will be readily understood. The let-off cock at the blow-up pan being turned, the blow-up liquor necessarily runs into the trays forming the roof of the filter chest; thence into the bag filters, and from them into the lower part of the chest. The first buckets full of liquor which pass are always turbid. The liquor is, therefore, allowed to flow away through the foul-liquor cock, until a portion, being examined in a wine glass or phial by the transmitted light of a candle or lamp, appears quite bright.

This period having arrived, the whole mass of liquor is allowed to run on to the charcoal filter, or cistern, as it is more generally called. These charcoal filters, or cisterns, are of various shapes, and made of various materials. The usual material is iron, and the usual shape that of a cylinder of about sixteen feet high, or more, by eight feet in diameter. Interiorly, the cylinder is supplied with a false and perforated bottom, on which is laid a piece of woollen. If made of iron, the cylinder should be internally well painted with two coats of white lead on one of red. Copper is the preferable metal, but few refiners will encounter the expense of using it for charcoal cisterns.

Instead of the deep charcoal cistern just described, some manufacturers employ shallow tanks of iron or lead. The only advantage which these shallow tanks present over deep cisterns is, that they are better adapted to low buildings, and do not involve any perforation of the floors. Unquestionably the decolorizing effect of charcoal is best exercised by the use of deep cisterns.

Cape of Good Hope.—Order in Council.—The Lords of the Treasury have caused Mr. Parker, one of their lordships' secretaries, to transmit to the commissioners of the customs a copy of an order in council directing a duty of 2s. per gallon to be charged upon spirits imported into the Cape of Good Hope, and to permit the delivery duty free of one gallon of spirits for every ten gallons of Cape wine exported or deposited in the warehouse for exportation.

We find it gravely asserted in an American paper that a subterranean channel has been discovered connecting the Pacific and Atlantic Oceans, and navigable throughout.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLIV.

(LECTURE LXXII.)

EXTRACTIVE.

Section II.—PURGATIVE EXTRACTIVE—(*Continued*).

ELATERIUM.

The fruit of the wild cucumber (Momordica elaterium) is a drastic purgative. It is hardly ever exhibited now, except in dropsy.

M. Morrus has produced from the juice of elaterium a white crystalline substance, to which he has given the name of "elaterin."

Elaterin crystallizes in lustrous rhomboid prisms. It has a bitter and styptic taste; it is insoluble in water, but dissolves readily in alcohol and in ether; it fuses at a temperature of about 392° F.; its composition may be represented by the formula:—

$$C_{20}\ H_{14}\ O_5.$$

The process by which M. Morrus obtains his elaterin is as follows:—He prepares, in the first place, the extract of elaterium; this extract he treats with water; the residuary mass which refuses to dissolve in the water he dissolves in alcohol. He then evaporates the alcoholic solution to the consistence of a syrup, when he obtains numerous crystals of impure elaterin, which he purifies finally by washing in ether. The mother liquors treated with solution of potass yield a fresh deposit of impure elaterin.

Zwinger suggests the following method:—Treat the elaterium with alcohol, distil off one half of the product, and precipitate the impure elaterin from the residue by the addition of water; dry the elaterin obtained, wash it with ether, and redissolve in absolute alcohol. From this alcoholic solution the elaterin crystallizes by slow evaporation.

Elaterin, even when exhibited in small doses only, provokes nausea, and produces vomiting and liquid stools.

Paris obtained a soft, green, resinous mass, which he found possessed of considerable power as a purgative. This substance, which he called elatin, would simply appear to be elaterin in an impure state.

Besides elaterin, the juice of elaterium contains, according to Braconnot and Paris, an amylaceous matter, non-purgative extractive, vegetable albumen, and some salts.

EXTRACT OF ELATERIUM.

Take of ripe fruits of elaterium any quantity you like, crush the fruits, remove the seeds, pulp the flesh, and squeeze out the juice. Clarify with the aid of heat, and evaporate to the consistence of an extract.

This process appears to be good; we cannot, however, positively assert that it is unexceptionable: there can be no doubt but that the deposit which subsides in the elaterium juice, if the latter is permitted to stand at rest, acts as a purgative in very small doses; and it is, moreover, from this deposit that M. Morrus has extracted the elaterin.

Certain Pharmacopœias recommend, accordingly, to use this deposit, evaporated at a gentle heat, as extract of elaterium.

This latter extract is a much more powerful purgative than that prepared with the whole juice.

The deposit which subsides in the juice of elaterium was formerly used under the designation of starch of elaterium.

ALOES.

Aloes is a vegetable juice furnished by several species of the genus Aloe, but principally by Aloe perfoliata, Aloe elongata, and Aloe spicata.

In commerce we distinguish several varieties of aloes, but Aloes succotrina is the only variety used in medicine.

Bouillon-Lagrange and Vogel looked upon aloes as a mixture of resin and extractive matter; Braconnot considered it to be a peculiar principle. Yet there can be no doubt but that aloes is a mixture or combination of several principles. The task to ascertain the nature of these principles, and the manner in which they are associated, must be left to future chemical analyses and researches.

Aloes dissolves readily in alcohol; it dissolves likewise in boiling water, but a portion of it precipitates again upon cooling. The precipitated portion may, by repeated ebullitions, be converted into a matter perfectly insoluble in water.

Aloes is an important medicinal agent; in small doses it acts as a stomachic, in larger doses as a purgative. It exercises a special action upon the rectum, and is preferred on this account to other purgatives, in cases where it is desired to produce a somewhat sustained effect.

I. PREPARATIONS CONTAINING THE WHOLE SUBSTANCE OF THE ALOES.

POWDER OF ALOES.

Reduce the aloes to powder by trituration.

The powder of aloes has a gold-yellow colour.

It is hardly ever exhibited unmixed, on account of its excessive bitterness; but it constitutes the basis of a great many preparations of aloes.

A small quantity of the powder only should be prepared at a time.

ALOES PILLS.

Take of Aloes, in powder, any quantity you like.
White honey, a sufficiency.

Mix into pills of 10 centigrammes each.

Pills are the most convenient form for the exhibition of aloes, for this reason, that they spare the patient the disgust which necessarily attends the ingestion of this substance in any other form.

The ancients used a great many formulas of compound pills, of which aloes formed the basis, or, at all events, one of the most active and energetic ingredients. Some of these preparations have retained their position, and are still prescribed with success by the medical profession. Among these are the pills called Antecibum, Anderson's pills, and the so-called pills of health (Grains de Santé); the formula of the latter is a secret; they appear, however, to consist simply of a mixture of liquorice juice and aloes, dissolved in water, and evaporated to the proper consistence.

PILLS ANTECIBUM.

Take of Aloes, 6 parts.
Extract of bark, 3 parts.
Cinnamon, 1 part.
Syrup of wormwood, a sufficiency.

Mix, and make into pills of 20 centigrammes each.

Each pill contains about 10 centigrammes of aloes.

These pills are used as tonic and digestive.

ANDERSON'S PILLS.

Take of Powder of aloes,
Powder of gamboge, of each 6 parts.
Essence of aniseed, 1 part.
Syrup, a sufficiency.

Mix, and make into pills of 20 centigrammes each.

These pills are used for the same purpose as those of the preceding formula. Each pill contains a little less than 10 centigrammes of aloes and the same quantity of gamboge.

HYDRAGOGUE PILLS OF BONTIUS.

Take of Aloes,
Gamboge,
Gum ammoniacum, of each 1 part.
Vinegar, 6 parts.

Dissolve the aloes and the two gum resins in the vinegar, with the aid of heat; strain the solution, and evaporate to pilular consistence. Divide into pills of 20 centigrammes each.

PILLS OF ALOES AND SOAP.

Take of Aloes, 2 grammes.
Medicinal soap, 3 grammes.
Volatile oil of anise, 1 drop.

Mix, and make into pills of 20 centigrammes each. Each pill contains about 7 centigrammes of aloes.

ALOES CLYSTER.

Take of Aloes, 2 to 8 grammes.
Lukewarm water, 500 grammes.
The yolk of an egg.

F.S.A.

BORIES' INJECTION OF ALOES.

Take of Aloes, 50 centigrammes.
Hydrochlorate of ammonia, 20 centigrammes.
Rose honey, 30 grammes.
Fennel-water, 200 grammes.

F.S.A.

This injection is used against gleet.

POMATUM OF ALOES.

Take of Aloes, 1 part.
Hogslard, 4 parts.

Mix.

Used as a vermifuge (in frictions).

II. ALOES AND ALCOHOL.

As aloes is completely soluble in alcohol, the alcoholic tinctures of that substance contain the whole of its constituent principles.

TINCTURE OF ALOES.

Take of Aloes, 1 part.
Alcohol of 86 C. (34° Cartier), 5 parts.

Dissolve by maceration; filter.

ELIXIR OF LIFE.

Take of Aloes, 9 parts.
White agaric,
Gentian-root,
Rhubarb,
Saffron,
Cinnamon,
Zedoary,
Theriac, of each 1 part.
Sugar, 8 parts.
Alcohol of 56 C. (21° Cartier), 450 parts.

Divide the alcohol into two equal parts; let the aloes and other ingredients macerate in the one half of the alcohol; strain the solution, and let the grounds again macerate in the other half of the alcohol; strain, pour the two solutions together, and clarify by filtration.

Thirty grammes of the elixir contain about 60 centigrammes of aloes.

This elixir is used as a stomachic and gentle purgative, in doses of 8 to 32 grammes.

ELIXIR OF PARACELSUS.

Take of Tincture of Myrrh, 4 parts.
" Saffron,
" Aloes, of each 3 parts.

Mix.

This is the formula which is mostly used at present.

III. ALOES AND WINE.

WINE OF ALOES.

Take of Aloes, 8 parts.
Lesser cardamoms,
Ginger, of each 1 part.
Spanish wine, 250 parts.

Thirty grammes of this vinous tincture contain one gramme of aloes.

BRUN'S COLLYRIUM.

Take of Aloes, 4 grammes.
Rose-water,
White wine, of each 48 grammes.
Tincture of saffron, 30 drops.

This collyrium is used as a wash for small ulcers in the eyelids.

IV. PRODUCTS OBTAINED BY THE ACTION OF WATER UPON ALOES.

Aloes is completely dissolved by boiling water. In cold water it is only partially soluble. We know very little of the respective and relative nature of the dissolved and undissolved part; it would appear, however, that the latter contains a larger proportion of the purgative principles of the aloes than the former, since we find that the aqueous extract of aloes acts much more mildly than the powder or alcoholic tincture of that substance.

EXTRACT OF ALOES.

Take of aloes any quantity you like. Break the aloes to pieces, place the latter on a diaphragm, and keep this immersed in cold water, until the soluble part is dissolved out. Strain the solution, and evaporate to the consistence of an extract.

V. PRODUCTS OBTAINED BY THE DISTILLATION OF ALOES WITH ALCOHOL.

ELIXIR OF GARUS.

[We have given two or three formulæ for the preparation of this elixir in Nos. 124 and 125 of the *Chemical Times*.]

SECTION III.—DIAPHORETIC, DIURETIC, ANTHELMINTIC, DEPURATIVE, ETC., ETC., EXTRACTIVES.

This series comprises many of the most important medicinal agents, principally the following:—

Digitalis,
Squills,
Ergot of rye,
Arnica montana,
Asarum europæum,
Narcissus pseudo-narcissus,
Juglans regia,
Lactuca sativa,
Lactuca virosa,
Borrago officinalis,
Burdock (Arctium lappa),
The bark of Ulmus campestris,
Elderberrics,
Sorrel,
Seeds of the leguminous plants.

DIGITALIS.

The foxglove (Digitalis purpurea) is one of the most valuable medicinal agents. It is the surest diuretic known to us; its diuretic properties render it one of the most serviceable remedies in the treatment of dropsy. It exercises also a very decided action upon the circulation. It retards the movements of the heart.

Digitalis is a bisannual plant. The leaves should be gathered the second year, at the period when the stem commences to rise. They should be taken from the non-cultivated plants only that have grown up naturally in a dry soil.

Digitalis has been analyzed by several chemists. It contains:—

Digitalin,
Volatile oil,
A concrete, floeculent, volatile matter,
Fatty matter,
Tannin,
Gallic acid,
A red colouring matter, soluble in water,
Gluten (albumen),
Chlorophyle,
Sugar,
Mucilage,
Binoxalate of potass.

On distillation digitalis yields, according to M. Morin, a colourless oily acid, which bears considerable resemblance to valerianic acid.

MM. Homolle and Quevenne were the first chemists who obtained digitalin in a state of purity.

Digitalin is a white, inodorous, difficultly crystallizable substance, which presents itself mostly in porous mammelonated masses, or in small scales. It is so intensely bitter that it communicates a marked bitterness to 200,000 parts of water. Yet the taste of the solid digitalin is only slowly developed in the mouth, on account of its sparing solubility in water.

Digitalin in powder provokes violent sneezing. It is almost impossible to triturate even a small quantity of it without exciting an attack of sneezing.

Digitalin is neutral to test-papers; it contains no nitrogen. Heat decomposes it; at 392° Fahr. it acquires colour and loses its bitter taste. It is very sparingly soluble in water, requiring for its solution 2,000 parts of cold and 1,000 parts of boiling water. Evaporation of the solution is attended with partial alteration of the digitalin.

Alcohol dissolves digitalin freely. Boiling alcohol dissolves a greater proportion than cold alcohol, and yet the boiling alcoholic solution fails to deposit the smallest quantity of digitalin upon cooling. The more concentrated the alcohol the more readily will the digitalin dissolve in it, but even weak alcohol dissolves a rather large proportion of this substance.

The alcoholic solution of digitalin, when left to spontaneous evaporation, deposits the digitalin partly in crystals, partly in powder.

Ether is almost without action upon digitalin. 100 grammes of ether dissolves only 0.34 grm. of this substance.

Tannin precipitates digitalin from its solutions in form of a white, amorphous compound, which is exceedingly soluble in water. According to M. Nativelle, the digitalin exists in the plant as a tannate.

Concentrated hydrochloric acid dissolves digitalin. The solution is of a beautiful emerald colour, even though only a small fragment of digitalin be present.

Alkalis destroy gradually the bitter taste of digitalin. If a mixture of digitalin with an alkali be dried, the bitter taste of the digitalin will be found completely gone.

Digitalin is obtained by the following process:—Reduce the dry leaves of the foxglove to a coarse powder, moisten the latter, put it into the displacement apparatus, and lixiviate with water. Mix the liquors obtained, precipitate the fluid with subacetate of lead in slight excess, and filter. The filtrate is limpid, almost perfectly colourless, very bitter, and manifests a slightly acid reaction. Add to the filtrate solution of carbonate of soda as long as a precipitate continues to form. Filter again, and remove the lime from the filtrate by means of oxalate of ammonia, and the magnesian salts subsequently by means of phosphate of soda and ammonia. Filter.

The filtrate manifests a decided alkaline reaction; it has a light yellowish-brown colour, and excessively bitter taste. Precipitate now with solution of tannin in slight excess; collect the precipitate on a filter, and free it from part of the adherent mixture by slight compression between a few leaves of unsized paper. Mix the still moist precipitate with the one fifth part of its own weight of porphyrized oxide of lead. Throw the soft pasty mixture on a filter, and let it drain; compress it subsequently again between a few leaves of unsized paper, and achieve the process of desiccation in the stove. Reduce the dry mass to powder, and treat the latter with concentrated alcohol.

Evaporate the alcoholic solution at a gentle heat, but not to dryness; you will obtain as residue a yellowish granular mass, surrounded with a small quantity of mother liquor. This mass consists of the bitter principle, mixed still with the traces of oil, salt, and extractive substances.

Wash the mass with a little distilled water, by which means you will remove the deliquescent salts without dissolving any perceptible amount of the bitter principle. Let it drain, and redissolve in boiling alcohol. Add to the solution a sufficient amount of animal charcoal, washed previously in hydrochloric acid, boil the mixture, and filter. The filtrate is colourless. Leave it to spontaneous evaporation in a stove, when the digitalin will be deposited partly on the sides of the vessel, in light, thin, semi-transparent layers, and partly at the bottom, in whitish, granular, agglomerated flakes.

Dry the deposit thoroughly, and reduce it to powder. Pour rectified ether over the latter, and leave the mixture in contact for twenty-four hours. Boil, and filter.

Collect the undissolved digitalin on the filter, dry it, and keep it in a glass bottle.

Digitalin exercises a very marked action upon

the animal economy. It diminishes the activity of the circulation.

It should be used with the utmost caution: even in doses of as little as one centigramme it may cause grave accidents. It is administered in pills, syrup, and potions. I hold, however, that it is much better to use the powder of digitalis instead of the digitalin. The powder acts in small doses, and thus no objection against its administration could possibly be rested upon the bulkiness of the dose. The powder possesses, moreover, more of the physical characteristics of the digitalis (colour and smell) than the digitalin: it is, accordingly, much easier to judge of its good quality from its external appearance, &c., than it is to pronounce on the purity of digitalin from outward appearances, since that substance possesses no very striking characteristics in that respect.

SYRUP OF DIGITALIN.

Take of Digitalin, 10 centigrammes.
Simple syrup, 100 grammes.

Dissolve the digitalin in a little alcohol, and add the solution to the syrup. 10 grammes of the syrup contain 1 milligramme of digitalin; a tablespoonful of the syrup contains 2 milligrammes of the latter principle.

I. PREPARATIONS CONTAINING THE WHOLE SUBSTANCE OF THE DIGITALIS.

POWDER OF DIGITALIS.

The best way is to reduce the leaves to powder without leaving any residue.

The leaves of digitalis, more particularly when in the pulverulent state, lose gradually their medicinal properties. It is, accordingly, advisable to replace them frequently by fresh leaves.

The dose of the powder of digitalis may be raised gradually from one decigramme to one gramme.

II. PRODUCTS OBTAINED BY THE ACTION OF WATER UPON DIGITALIS.

INFUSION OF DIGITALIS.

Take of Dry leaves of digitalis, 2 grammes.
Boiling water, 100 grammes.

Infuse for half an hour; strain.

Dr. Andral and Dr. Trousseau recommend the infusion as one of the best forms in which to exhibit digitalis.

SYRUP OF DIGITALIS.

Take of Leaves of digitalis, 2 grammes.
Boiling water, 1,000 grammes.
White sugar, a sufficiency.

Let the leaves infuse in the water; strain with expression, and filter. Dissolve in every 100 parts of the filtrate 180 parts of sugar, at the heat of the water-bath.

30 grammes of this syrup contain the substance of 20 centigrammes of digitalis.

M. Ovide Ferrier recommends to prepare this syrup with five centigrammes of alcoholic extract of digitalis to thirty grammes of syrup. The product obtained by this process is more active than that prepared according to the preceding formula of the Codex. According to M. Ferrier, it resembles the syrups of Labelonye. (This latter preparation seems to have for its base a mixture of simple syrup and syrup of maidenhair.)

EXTRACT OF DIGITALIS.

Take of dry leaves of digitalis any quantity you like; reduce the leaves to a semi-fine powder; moisten the latter with one half its own weight of water of 68° F.; heap it rather lightly in the lixiviation apparatus, and lixiviate; heat the liquor obtained in the water-bath, strain, and evaporate to the consistence of an extract.

I obtained from one hundred parts of leaves, extracted with distilled water, thirty-two parts of an extract of firm consistence. One part of the extract would, accordingly, represent three parts of the powder of digitalis.

The aqueous extract of digitalis is not to be depended upon. As the digitalis is very liable to suffer alteration under the influence of water and heat, the evaporation of the liquor is almost necessarily attended with decomposition of a portion of the active principle. At all events, it is advisable to operate with highly-concentrated liquor only, and to effect the evaporation in the water-bath with the utmost possible promptitude.

III. PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL ON DIGITALIS.

ALCOHOLIC EXTRACT OF DIGITALIS.

Take of Digitalis, any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Operate by the usual method of lixiviation.

I obtained from one hundred parts of leaves, extracted with alcohol of 56 C., thirty-eight parts of an extract of firm consistence; one part of the alcoholic extract represents, accordingly, 2.6 parts of the powder of digitalis.

TINCTURE OF DIGITALIS.

Take of Dry leaves of digitalis, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the leaves macerate in the alcohol for fifteen days; strain with expression; filter.

Five parts of this tincture represent a little short of one part of digitalis.

The French Codex prescribes to prepare this tincture with four parts of alcohol of 80 C. to one part of digitalis.

M. Personne maintains, however, that alcohol of 56 C. dissolves a larger proportion of matter than alcohol of a higher degree of spirituosity.

ALCOHOLATE OF DIGITALIS.

Take of Fresh leaves of digitalis,
Alcohol of 86 C. (34° Cartier), of each equal parts.

Bruise the digitalis, add the alcohol, and leave the mixture at rest for a few days. Strain subsequently with expression, and filter.

I greatly doubt whether the product is in any way superior to that prepared with the dry leaves.

IV. PRODUCTS OBTAINED BY THE ACTION OF ETHER UPON DIGITALIS.

ETHEREAL TINCTURE OF DIGITALIS.

Take of Leaves of digitalis, 1 part.
Sulphuric ether, 4 parts.

Operate by lixiviation in a close funnel, and displace the last portions of the ether by water. Keep in tight-stoppered flasks.

The efficacy of this tincture, highly extolled by some, is altogether denied by other, practitioners.

V. PRODUCTS OBTAINED BY THE ACTION OF VINEGAR UPON DIGITALIS.

VINEGAR OF DIGITALIS.

Take of Dry leaves of digitalis, 1 part.
White vinegar, 12 parts.

Let the leaves macerate in the vinegar for eight days; filter.

Dr. Nasse recommends this vinegar as a powerful diuretic.

ACETIC SYRUP OF DIGITALIS.

Take of Vinegar of digitalis, 10 parts.
Sugar, 18 parts.

Diffuse the sugar in the vinegar at a gentle heat.

This preparation differs little from the oxysaccharum of digitalis, recommended by Dr. Martin as a valuable remedy in pulmonary consumption, and of which the formula is as follows:—

Take of Dry leaves of digitalis, 1 part.
Distilled vinegar, 8 parts.

Let the leaves digest in the vinegar, at a gentle heat; strain with expression; add ten parts of sugar to the liquid, let the sugar dissolve at a gentle heat, and filter.

VI. PRODUCTS OBTAINED BY THE ACTION OF FATTY SUBSTANCES ON DIGITALIS.

POMATUM OF DIGITALIS.

Take of Fresh leaves of digitalis, 1 part.
Hogslard, 2 parts.

Boil over a gentle fire, until the whole of the aqueous moisture is expelled.

Approximate Relative Values of the different Preparations of Digitalis.

One part of dry picked leaves of digitalis, or of powder of digitalis, is represented by—

Aqueous extract....	0.33	parts.
Alcoholic extract....	0.4	"
Syrup	144	"
Alcoholic tincture ..	5	"
Alcoholate	9	"
Ethereal tincture ..	4	"
Oxysaccharum	16	"

SQUILLS.

The squill is the bulb of Scilla maritima. It has been analyzed by M. Vogel and M. Tilloy. It contains:—

A volatile matter,
Scillitin,
Resin,
Gum,
Tannin,
Citrate of lime,
Saccharine matter,
Fatty matter.

The volatile matter has not yet been studied, but its irritating effects upon the skin are well known.

Scillitin is an uncrystallizable body. It has an acrid and bitter taste. It is soluble in alcohol, in water, and in alcoholized ether, but insoluble in pure ether. Its action on animals is most energetic: one grain suffices to kill a dog.

The following is M. Tilloy's process of preparing scillitin:—Prepare, in the first place, tincture of squills with alcohol of 85 C.; distil the tincture, and evaporate to the consistence of a soft extract. Dilute this extract in alcohol of 88 C., when a matter of resinous aspect and saccharine taste will separate; remove this, and evaporate the alcoholic fluid once again to the consistence of an extract. Subject the extract to the action of ether, which will remove a fatty matter of a deep yellow colour and bitter taste. Treat the residue which the ether leaves undissolved with water; this will effect the separation of a considerable amount of bitter resin in form of a light yellow powder. Filter the aqueous fluid off this powder, and evaporate the filtrate to the consistence of an extract. Dissolve the extract in alcohol, and mix the solution with ether, when you will obtain a deposit of saccharine matter. The solution contains now the pure scillitin, which is then finally obtained in the solid state by evaporation.

The squill has a special action upon the kidneys and lungs. It is a most excellent diuretic, and enjoys a high and deserved reputation for efficacy in cellular infiltrations, and certain dropsies. It is also given with success in asthma and chronic catarrhs. It facilitates expectoration.

DESICCATION OF SQUILLS.

The bulbs of the red squill are usually preferred. The outer coats (which are partially shrivelled and decomposed) are removed; the central parts, in which the juices are not sufficiently elaborated, are equally rejected. The remainder is cut into thin slices, which are then spread upon a hurdle and dried in the stove. They lose more than four fifths of their weight in the process of drying.

The operator should protect himself as much as possible from the action of the acrid matter. He must more particularly avoid putting his fingers which have handled the squills to his face.

POWDER OF SQUILLS.

Pound the dried squills without leaving any residue.

The powder of squills attracts moisture from the air with avidity. It is to be kept, therefore, in tight-stoppered flasks; but no precaution can prevent its clotting some time after its preparation. It is, accordingly, always advisable to prepare only a little at a time.

COMPOUND POWDER OF SQUILLS.

Take of Powder of squills, 1 part.
Flowers of sulphur, 2 parts.

Take of Sugar, 3 parts.
Mix.
This powder is given in asthma, in doses of 1 gramme to 1½ gramme.

PILLS OF SQUILLS.

Take of Powder of squills, 3 parts.
Gum ammoniacum, 1 part.
Oxymel of squills, a sufficiency.
Mix, and make into pills of 20 centigrammes each.

MELLITE OF SQUILLS.

Take of Dried squills, 1 part.
Boiling water, 16 parts.
White honey, 12 parts.
Let the squills infuse in the water, strain, add the honey, and boil to the consistence of syrup. Or, better still, concentrate the infusion, and prepare the mellite by simple solution in the water-bath.

TINCTURE OF SQUILLS.

Take of Dried squills, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.
Let the squills macerate in the alcohol for fifteen days; strain with expression, and filter.

ALCOHOLIC EXTRACT OF SQUILLS.

Take of Dried squills, 1 part.
Alcohol of 56 C., 6 parts.
Let the squills macerate for several days in two thirds of the alcohol; strain with expression. Let the grounds macerate in the remaining third of the alcohol; strain. Pour the liquids together, filter, distil, and evaporate the residue to the consistence of an extract.
The squill yields two thirds of its own weight of extract.

WINE OF SQUILLS.

Take of Dried squills, 1 part.
Malaga wine, 16 parts.
Let the squills macerate in the wine for twelve days; strain with expression, and filter.

VINEGAR OF SQUILLS.

Take of Dried squills, 1 part.
Strong vinegar, 12 parts.
Let the squills macerate for some days; strain with expression, and filter.

OXYMEL OF SQUILLS.

Take of Vinegar of squills, 100 parts.
Honey, 200 parts.
Evaporate the vinegar in the water-bath until it weighs 29; add the honey, and prepare a mellite by simple solution; clarify by filtration through paper (by Desmarets' method).

THE THEORY AND PRACTICE OF THE PRODUCTION OF LIGHT.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION, ON FRIDAY, FEBRUARY 2, 1849,

By W. T. BRANDE,
Late Professor at the Institution, and Assayer of her Majesty's Mint.

I scarcely know any subject of a chemical nature of more interest or importance, whether theoretical or practical, than the investigation of those properties which form the conditions of combustion, and which are concerned in producing light. When we remember that a few years ago we were sitting under the dark reign of mould candles and single-wick oil-lamps, and that now we scarcely see either, we are reminded of the rapid progress made in the applied sciences bearing on the interests, the convenience, and the arts of life. My object to-night is to put before you, as briefly and perspicuously as possible, a few of the leading principles on which this progress hinges; and I do so with more interest as it was here, within these walls, that Davy first developed his beautiful theory of flame, gave an entirely new impulse to the arts in which flame performs an important part, and threw a light upon all the intricacies of the phenomena of combustion in which the mutual relations of heat and light are concerned.

The causes of the evolution of light from a common flame may be referred to two phenomena, ignition and combustion. Both of these are united in the production of those flames which are used as common sources of light. Ignition is, perhaps, a physical rather than a chemical condition of matter. The ignited substance may, or may not, undergo chemical change, but in general it does not. On the other hand, combustion is a truly chemical phenomenon, and in it the heat and light continually evolved are the result of a succession of chemical changes following each other. In the former case there is no destruction of matter, in the latter there is; that is, those changes in the constitution of the burnt body take place, which break down the arrangement of its particles, and cause what we somewhat loosely term the destruction of the substance.

When a piece of platinum wire is put into a common flame, we find that the platinum is ignited and the amount of light evolved is considerably increased; the platinum wire is then in a state of ignition, undergoing no change, and, when the metal is removed from the source of heat, it cools down to its former state. On the other hand, if I take a small quantity of spirit of wine and ignite it under a close vessel, combustion ensues, water and carbonic acid are produced, and the spirit of wine disappears. Now, one of the most important facts pointed out by Davy was the relation between the heat and light of flame. He showed that there are many substances capable of becoming intensely hot and yet giving out scarcely any light; and again, there are a set of flames extremely luminous, and yet giving out no proportionate heat. Let us first examine what happens in regard to the more luminous flames depending on the presence of solid bodies. We will first, in order to advance with a sure march, take the flame of hydrogen gas, a vapour with which no solid body is intermingled. I have arranged that it shall flow from this aperture, and I ignite it; it is an exceedingly hot flame, but it gives out scarcely any light, and, indeed, it is hardly visible; but, to make you aware of its intense heat, I need only take a piece of platinum wire and you see it becomes white hot in the hydrogen flame, and concurrently with this I get, by the presence of the platinum, an immense quantity of light. We have only to imagine that, in order to make that flame luminous, there shall be a number of small points or particles of solid matter diffused throughout the flame, and we shall get combustion on the one hand and ignition on the other—ignition giving light, and combustion causing heat and ultimately light also. Here is another instance in which the luminosity of hydrogen will be very much increased by the mere help of a little charcoal, which I bring before you as giving a clear illustration of what goes on in a familiar light-giving flame.

The flame in its simple condition is burning dimly, but shake a little finely-powdered charcoal into it, and the particles throughout the flame becoming ignited give it a very considerable luminosity. The charcoal in this case plays the same part as the platinum did before, and so renders the flame luminous. I can repeat this experiment in a much more delicate manner. I take a current of hydrogen gas, and before burning it I charge it with charcoal or carbon, not by mixing powdered charcoal with it, but by passing it through some hydrocarbon. When I do this the hydrogen licks the carbon up, as it were, and emerges as carburetted hydrogen: when so mixed it has acquired great illuminating power, which it owes to the presence of the carbon.

But there is another point of considerable practical importance; it is, that when you heat this carburetted hydrogen to an excessive temperature the carbon is converted into gas too rapidly, and does not become incandescent in the interior of the flame; and, on the other hand, if you allow it to become cool, the carbon begins to fall down, not into the flame to be ignited, and add to the whiteness of the light but out of the flame altogether. If you mix as much air with your flame as will convert all these solid particles, which you need in that state, into vapour or carbonic acid gas, you will have a pale flame; but, if you allow only a moderate quantity of air to have access, the charcoal particles which form part of the carburetted hydrogen gas are precipitated into the interior of the flame, and you have then a very luminous white light, because, as I have explained, you have the presence of particles of solid matter in your flame. That this is the explanation of the increase of light I may show by passing iron filings through the flame of spirit of wine. When I drop a few of these particles through that hot flame the addition immediately imparts a luminosity entirely due to their solid state, which renders them, in their transient passage, capable of ignition and of luminosity. But the iron not being combustible, or, at least, remaining in the solid state after ignition, it falls through the flame, whereas charcoal is itself combustible; it is gradually thrown out of the flame and converted into a gas, in which form it passes away. Here is a jet of the mixed gas; its flame is luminous; the charcoal is assisting and increasing the amount of light; but cool the gas by admitting an excess of air and we have evidence of the charcoal in another way. Soot is thrown down, while in the white flame these carbonaceous particles are converted into carbonic acid. If you could get a piece of invisible incombustible matter into the centre of the flame, so as to have it intensely heated, you would have a very brilliant illumination.

This has been done in the Drummond light. In this light a mixture of hydrogen and oxygen gas, having by itself a feebly illuminating power, but capable of rendering any substance exposed to its combustion intensely hot, is directed on to a piece of wire, and the heat evolved soon renders the solid body incandescent. It is an important, though not a peculiar, property of the oxhydrogen or Drummond light that it displays objects without changing the colours which they present under the light of the sun. There are certain colours more prone than others to disappear under particular artificial lights. Some of the flames I shall presently have to exhibit will place this fact very strikingly before you, but the most trying colours are faithfully reflected under the Drummond light,—a fact which places it nearer than many others to the solar ray in its constitution and effects. It also creates a prismatic spectrum very similar to that of the solar beam. The conditions requisite for a good light are that the solid matter which gives luminosity to flame must itself be combustible. This we have already seen, and, in addition, that the substance burnt must be gaseous, or capable of becoming gaseous, inodorous, and harmless, under the circumstances in which combustion is to take place. Take the case of a taper,—this taper for instance,—burning under a jar. As combustion goes on, the wax is decomposed with the air which surrounds it, a quantity of water is formed, and carbonic acid gas fills the jar. Now, carbonic acid gas is not harmless, that is to say, in large quantities, and with exclusion of external air it would be exceedingly pernicious; but the combustion of our candles, lamps, and fires may generate it in amazing quantities, and under ordinary circumstances it thoroughly mixes with the air, and no injury is sustained in consequence. There are numerous other substances beside carbon which might be used for the purpose of obtaining a good light; but these are liable to one or the other objection, which counterbalances their advantages. Thus, phosphorus would do: it gives an extremely vivid light; but, then, it also gives off phosphoric acid vapour, an exceedingly pernicious gas for breathing. Arsenic adds to the luminosity of flame, but this also produces a most pernicious result. The points to be considered are, then, the sources of light and heat, and the nature of the products of combustion. Now, we find that this solid matter, which is essential to the greatest illuminating power of flame, must be not only harmless and present in sufficiency, but it must not be in excess, because, if it is, we get

a fuliginous deposit from the flame. For a long time the great objection to burning hydrocarbons was the impossibility of constructing a lamp in which they would burn entirely without producing smoke. The invention of the camphine lamp for burning oil of turpentine advanced this great object very considerably; by this invention the method of preventing smoke was pointed out by sending a great quantity of air into the flame, while the quantity of camphine allowed to be burnt was comparatively small. A non-conductor is interposed between the flame and the oil of turpentine, so as to prevent the latter becoming heated and prematurely volatilized, and thus we get a beautiful ring of light. Nevertheless, in this lamp the proportions of air and camphine require nice adjustment, because too much or too little of either would lead to the deposition of unburnt carbon, or, in other words, would make the lamp smoke. Now, since the invention of that lamp, there have been many contrivances for burning hydrocarbons attempted, and, as those substances are very abundant, these attempts merit attention. I have on the table a substance which has the appearance of a very thick oil designed for combustion in common lamps: it is derived from petroleum. It is composed of 80 per cent. of what Mr. Young calls mineral oil, 5 per cent. of a very inflammable liquid analogous to naphtha, and capable of dissolving indiarubber; it also contains 5 per cent. of paraffine, a fatty substance, giving separately a most beautiful light; but I refer to this thick oil, not to notice the two last-named ingredients, but for the sake of the mineral oil.

This oil is worth about 4s. per gallon; it burns very well, indeed, in an ordinary argand lamp, giving the light of seven candles, at a cost of about three eighths of a penny per hour. In two points petroleum is defective: it wants the volatility of camphine, and contains a less amount of carbon. The progressive improvements in the manufacture and management of coal-gas enable us to get a good light in a very simple manner, and to ascertain with tolerable accuracy the quantity consumed; but there is one point in connection with this subject of very great practical importance. I refer to the quantity of gas really necessary to furnish a given amount of light, because it does not follow that, irrespective of modes of combustion, the same amount of gas consumed will furnish the same amount of light. You may burn a limited quantity of gas and have a very splendid light with one arrangement, while with another a prodigious consumption may be going on and but little light obtained. It is then important to ascertain under what circumstances a maximum amount of light is obtainable. The arrangement which I have placed on the table this evening, and which, I think, brings the true principles of economizing gas into application, is the very beautiful burner of Mr. Leslie, which is most probably well known to many of you. I am sorry my time will not permit me to go into the details of the consumption of gas, but, perhaps, it is scarcely necessary; but there are some points about this flame which may be made obvious on the instant, and without long calculations. See the beautiful, clear, steady, white flame as it stands almost motionless in the glass. Now let me remove this glass and replace it by one of the common old cylindrical kind; the quantity of gas burnt is just the same at before, but every one sees that the light has lost all its best qualities. I have admitted too much air by so doing, and therefore get less light; the deposit of carbon goes on as before, but it now goes on too rapidly, and we have a smoke. To get the same amount of light with this glass we must burn twice the quantity of gas which was required with Mr. Leslie's burner.

One of the means sometimes resorted to for increasing the luminosity of a fainter flame is by what is called the napthalisation of gases. There are here two gas-burners, precisely similar in construction: one of them is supplied with gas in its commercial state, the other with gas of the same kind, but passed over a vegetable oil before arriving at the orifice at which it burns. In this way certain parts of the oil are licked up and carried directly into the flame. Care must be taken so to arrange the apparatus as to allow only a proper quantity of the oil to be absorbed, since any excess of that element renders the flame smoky. To produce an available illuminating flame, the substance employed must be either a gas or a vapour, or a solid material capable of becoming converted into such at the heat at which it burns. If I ignite iron filings in the flame of spirits of wine, you see a very bright light is evolved, but there is no additional flame contributed by the iron; this substance is incapable of assuming the gaseous form, and, therefore, it does not burn away with a flame. Now, if I take a substance from the same class of bodies as iron, but differing in respect of its being volatile, I get quite another result. Zinc is a volatile metal. When I place this in a chamber or vessel into which oxygen is freely admitted, and heat it strongly, it takes fire and burns with a beautiful white flame, and oxide of zinc is formed in great abundance. We are now able to grasp some of the principal conditions to be fulfilled in order to arrive at a perfect flame. We must have light without smoke, without odour or noxious vapour, a substance easily volatilizable, and bearing a proper relation to the conditions under which it is to be used. In a common candle all these points are illustrated: the wax is converted into vapour, that vapour becomes a source of light and flame, carbon is deposited and burnt, and so forth. But there is something more than this required: a light to be useful must be a white light; no particular colour must predominate, or the chromatic relations of every object illuminated will be disturbed. There is a familiar experiment in which we get a light showing every object in one yellow colour by burning spirits of wine with the addition of a little salt. The many-coloured figure hanging behind me reflects but one colour in this, the monochromatic light. It is obvious that such a mixture as this could never be useful for purposes of artificial light, and the more any light partakes of this property the more its unfitness for such purposes is evident.

In 1802 Sir Humphry Davy showed in this building experiments on the production of light by electricity, and pointed out the possibility, but not the probability, of applying lights of that kind arising out of the voltaic discharge to common purposes of illumination. While speaking of flame, and having heard so much about the electric light, I may be expected to say something of its nature. We all know that the discharge of natural electricity takes place with a most beautiful and intense light. Now, if we employ a battery like the one often used on these occasions, and connect the wires which lead off from its terminal plates with the ends of a discharger, substituting for its knobs a pencil of well-burnt boxwood charcoal, or of the substance found lining the interior of long-used coal-gas retorts, and move the rods, so that the charcoal points, as they are called, may lightly touch each other, a vivid light will appear between them, igniting their extremities, and heating the air so intensely that, on allowing the charcoal points to be withdrawn a little distance from each other, the discharge will continue with a most dazzling light through the intermediate portions of air. Now, this evolution of light is not dependent on the combustion of the charcoal, as may be demonstrated by placing the points in an air-pump vacuum. The electric light may be also shown in another way, by hanging a spiral roll of platinum wire in the interior of a glass tube, its ends being connected with the terminal wires of a battery. When contact is made the platinum is heated, and, on exhausting the vessel by means of an air-pump, the metal becomes white, and emits a most brilliant light, and the platinum at length fuses.

The contrivances which have been proposed for rendering this a continuous instead of a flickering and uncertain light are very numerous; but, so far as I have seen, not one has answered very well, although some are certainly very ingenious. But, supposing that they would answer perfectly, there is another question in the background. Until some mode is found out of producing electricity at a more economical rate, I certainly do not see the least chance of the most plausible of those plans being taken into earnest consideration for practical application. Could we get cheap electricity, the question would be to a great extent changed. In that case we might either use electricity, applied in the way we have been describing, or, what I think is the better plan, we might use it in the decomposition of water, naphthalizing its hydrogen, and burning that gas with the aid of oxygen. Such a light we have now burning on the table; it is liable to no uncertainty, and does not flicker. Lights of this kind, however, can only be available where an enormous illuminating power is required to be expended. The last-mentioned light, to produce which water is decomposed, its hydrogen carbonized, and the oxygen of the water sent into the flame, producing an enormous quantity of heat and light, seems to me the most feasible plan for obtaining a cheap, and therefore useful, electric light.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ACTION OF NITRO-SULPHURIC ACID (A MIXTURE IN EQUAL PROPORTIONS OF FUMING SULPHURIC AND FUMING NITRIC ACIDS) ON ORGANIC SUBSTANCES.

By M. AUGUSTUS CAHOURS.

[*Continued from page* 176.]

BINITRO-SALICYLIC ACID.

The binitric salicylate of methylene dissolves in dilute solution of caustic potass; from this solution it separates again intact, upon the addition of a mineral acid. But if the binitric salicylate of methylene is dissolved in a concentrated, instead of in a dilute, solution of caustic potass, a few minutes' ebullition suffices to decompose the binitric salicylate of methylene, and, as the product of this reaction, we obtain a salt of a magnificent red colour, crystallized in fine concentrically-grouped needles, and presenting the aspect of the splendid red velvet of Utrecht. This salt, when treated with boiling dilute nitric acid, acquires a light yellow colour, and dissolves completely in the menstruum if a sufficiently diluted acid has been used. Upon cooling this solution deposits a crystalline powder of a fine yellow colour, resembling in its outward appearance chromate of lead. This powder I regarded for a long time as the acid of the red potass salt, the nitric acid having been used in excess.

The yellow powder may be readily purified by washing with cold water, in which menstruum it is very sparingly soluble only.

I produced several samples of this product from various preparations. I found that these samples presented always the same external characteristics, manifested always the same properties, and yielded, upon analysis, perfectly concordant results, which I found it impossible to connect in any way or manner with the binitric salicylate of methylene. I felt, accordingly, constrained to defer the publication of those researches until I should be able to comprehend and explain the anomalies which this substance presented to me.

Thus I found that the properties of carbon and hydrogen agreed perfectly with the composition of carbazotic acid; this made me think at first that I had before me an isomeron of the latter compound, resulting from the reciprocal action of the potass and the binitric salicylate of methylene, as I stated in a note which I presented at the time to the Academy of Sciences. I was, however, speedily convinced that this supposition was erroneous, since repeated estimations of the nitrogen in the new compound showed

that the latter contained eight per cent. less of that element than is present in the carbazotic acid. Moreover, it seemed rather difficult to understand the formation of an isomeron of carbazotic acid under the conditions and circumstances which attend the formation of the new product.

As the formula deduced from numerous analyses of the new substance (yielding all perfectly concordant results) presented no affinity of composition with the binitric salicylate of methylene, I was led to inquire whether the new substance, instead of being a free acid, as I had assumed at first, from the fact that it had been obtained by treating the red potass salt with boiling dilute nitric acid in excess, might not, perhaps, contain some alkali. The circumstance that the bichloric and bichromic salicylic acids form with potass salts of sparing solubility, and which yield up their base to energetic acids only, seemed to speak greatly in support of this new supposition of mine. The results of repeated experiments have since fully established the correctness of that supposition: the yellow crystalline powder is, in fact, simply a potass salt which differs from the red salt in this, that it contains one equivalent of potass less than the latter.

If, instead of treating the red salt with dilute nitric acid, we subject it to the action of the most highly concentrated sulphuric acid, taking care to restrict the elevation of the temperature to 122° Fahr., we obtain sulphate of potass and a substance which cold water separates completely from the acid liquor.

The yellow salt treated in the same way yields the same result.

The new product is very sparingly soluble in cold water, but dissolves readily in boiling water. From this solution it crystallizes upon cooling in silky needles; when crystallizing from a dilute solution, by spontaneous evaporation, the form which it assumes is that of small hard prisms. This new product is the binitro-salicylic acid. It dissolves readily in alcohol and in ether. It fuses at a comparatively low temperature, and sublimates unaltered when heated with precaution. With a maximum of salts of iron it produces cherry-red coloration, analogous to that produced by indigotic acid, but of less intensity. Concentrated nitric acid transforms it promptly, upon ebullition, into carbazotic acid. Concentrated sulphuric acid dissolves it at a low temperature; water separates it again intact from this solution. If a mixture of concentrated and sulphuric acid and binitro-salicylic acid is heated to 212 Fahr., a destructive action ensues, a large amouut of sulphurous acid is disengaged, and a carbonaceous matter obtained.

The binitro-salicylic acid forms with potass, soda, and ammonia crystallizable, sparingly soluble, beautifully tinted salts. With the oxides of lead and silver it forms equally salts of very sparing solubility.

The analysis of this acid gave the following results:—

I. 0.500 grm. of substance yielded 0.083 of water and 0.674 of carbonic acid.

II. 0.462 grm. of the same sample yielded 0.076 of water and 0.623 of carbonic acid.

III. 0.423 grm. of the same sample yielded 43 cubic centimetres of nitrogen, at the temperature of 51.8 Fahrenheit, and under an atmospheric pressure of 761 millimetres (about 29.8), the gas being saturated with moisture.

IV. 0.495 grm. of another sample yielded 0.084 of water and 0.670 of carbonic acid.

V. 0.465 grm. of the same sample as IV. yielded 49 cubic centimetres of nitrogen, at the temperature of 57.2 Fahrenheit, and under an atmospheric pressure of 756 millimetres (about 29.6), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.	III.	IV.	V.
Carbon	36.78	36.72	..	36.92	—
Hydrogen...	1.84	1.81	..	1.89	—
Nitrogen	...	...	12.15	..	12.35
Oxygen....	—	—	—	—	—

and agree with the formula:—

$$C_{14}\,H_4\,N_2\,O_{14}.$$

Theoretically we have:—

C_{14}	1050	36.84
H_4	50	1.75
N_2	350	12.28
O_{14}	1400	49.13
	2850	100.00

This product, of which the rational formula may be written

$$C_{14}\,H_4\,O_6,\ 2(NO_4),$$

differs from salicylic acid,

$$C_{14}\,H_6\,O_6,$$

simply in this, that 2 equivalents of the hydrogen of the latter are replaced by 2 equivalents of hyponitric vapour.

The binitro-salicylic acid forms with potass two salts, which differ greatly in their external appearance: the one presents itself in form of concentrically-grouped needles of a beautifully red colour and velvety aspect; the other in form of a yellow crystalline powder. The former is a bibasic, the latter a neutral, salt.

BINITRIC SALICYLATE OF POTASS.

Red Variety.

This salt is obtained, as we have seen, by boiling binitric salicylate of methylene in a concentrated solution of potass. The solution acquires a very intense brown-red tint, and, upon cooling, deposits beautiful red concentrically-grouped needles.

The salt is purified by compression between two folds of blotting paper, and one or two recrystallizations.

When projected on burning charcoal, or on a very hot plate, it detonates strongly. Long-continued ebullition in concentrated solution of potass would seem to effect the complete decomposition of this salt.

The analysis of this salt gave the following results:—

I. 0.530 grm. of substance yielded 0.052 of water and 0.509 of carbonic acid.

II. 0.488 grm. of the same sample yielded 0.045 of water and 0.466 of carbonic acid.

III. 0.502 grm. of this same sample yielded thirty-nine cubic centimetres of nitrogen, at the temperature of 59° Fahr., and under an atmospheric pressure of 755 millimetres (about 29.6), the gas being saturated with moisture.

IV. 0.500 grm. of another sample yielded 0.048 of water and 0.481 of carbonic acid.

V. 0.487 grm. of the same sample as I., II., III. yielded 0.269 of neutral sulphate of potass = 0.145 of anhydrous potass.

VI. 0.500 grm. of the same sample as IV. yielded 0.279 of neutral sulphate of potass = 0.151 of anhydrous potass.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.	III.	IV.	V.	VI.
Carbon	26.19	26.05	..	26.22	—	—
Hydrogen. .	1.09	1.02	..	1.07	—	—
Nitrogen ..	..	..	9.05	—	—	—
Oxygen ..	—	—	—	—	—	—
Potass	..	..	..	..	29.95	30.35

Assuming the rational formula of the red potass salt to be,

$$C_{14}\,H_3\,N_2\,O_{13},\ 2KO,$$

we obtain by calculation:—

C_{14}	1050.0	26.83
H_3	37.5	0.95
N_2	350.0	8.95
O_{13}	1300.0	33.22
$2KO$	1180.0	30.05
	3917.5	100.00

Yellow Variety.

This salt is produced by treating the red variety with boiling dilute nitric acid in excess: it is deposited, upon cooling, in the form of a yellow crystalline powder. It is very sparingly soluble in cold water, and altogether insoluble in alcohol and in ether. Projected upon burning charcoal it detonates more feebly than the red variety. If it is treated with the most highly concentrated sulphuric acid, at a temperature not exceeding from 104° to 122° Fahrenheit, it dissolves and yields up the whole of the potass to the sulphuric acid; addition of water to the acid liquid effects the deposition of the binitro-salicylic acid, in form of thin crystalline plates.

The analysis of the yellow salt gave the following results:—

I. 0.453 grm. of substance yielded 0.045 of water and 0.520 of carbonic acid.

II. 0.484 grm. of the same sample yielded 0.049 of water and 0.555 of carbonic acid.

III. 0.445 grm. of the same sample yielded 39 cubic centimetres of nitrogen, at the temperature of 57.2 Fahrenheit, and at an atmospheric pressure of 754 millimetres (about 29.5), the gas being saturated with moisture.

IV. 0.504 grm. of another sample yielded 0.058 of water and 0.578 of carbonic acid.

V. 0.500 grm. of the same sample as IV. yielded 45 cubic centimetres of nitrogen, at the temperature of 64.4 Fahrenheit, and under an atmospheric pressure of 761 millimetres (about 29.8), the gas being saturated with moisture.

VI. 0.520 grm. of a third sample yielded 0.057 of water and 0.600 of carbonic acid.

VII. 0.554 grm. of the same sample as VI. yielded 0.176 of neutral sulphate of potass = 0.095 of anhydrous potass.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.	III.	IV.	V.	VI.	VII.
Carbon	31.30	31.26	..	31.27	..	31.46	—
Hydro.	1.10	1.12	..	1.27	..	1.21	—
Nitrog.	..	..	10.24	..	10.42	—	—
Oxygn.	—	—	—	—	—	—	—
Potass.	..	..	..	..	..	..	17.46

Assuming the formula of the yellow variety to be

$$C_{14}\,H_3\,N_2\,O_{13},\ KO,$$

we obtain by calculation:—

C_{14}	1050.0	31.58
H_3	37.5	1.13
N_2	350.0	10.53
O_{13}	1300.0	39.10
KO	590.0	17.66
	3327.5	100.00

BINITRIC SALICYLATE OF AMMONIA.

The binitro-salicylic acid dissolves readily in liquid ammonia, with which it combines, forming the binitric salicylate of ammonia; this salt is deposited, upon evaporation of the solution, in small needles of a beautiful yellow colour.

The analysis of the binitric salicylate of ammonia gave the following results:—

I. 0.500 grm. of substance yielded 0.125 of water and 0.632 of carbonic acid.

II. 0.420 grm. of the same sample yielded 63 cubic centimetres of nitrogen, at the temperature of 60.8 F., and under an atmospheric pressure of 755 millimetres (about 29.6), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers:—

	I.	II.
Carbon	34.46	—
Hydrogen ..	2.78	—
Nitrogen....	..	17.38
Oxygen	—	—

Theoretically we have:—

C_{14}	1050	34.28
H_7	87.5	2.85
N_3	525.0	17.14
O_{14}	1400.0	45.73
	3062.5	100.00

BINITRIC SALICYLATE OF BARYTA.

The binitro-salicylic acid produces in water of baryta a precipitate, which subsides in the form of an orange-yellow powder.

BINITRIC SALICYLATE OF SODA.

This salt is obtained in the form of yellow needles of satin-like aspect. It is much more soluble than the corresponding potass salt.

BINITRIC SALICYLATE OF SILVER.

Nitrate of silver dissolves in a dilute and hot solution of binitro-salicylic acid; upon the refrigeration of the solution the new-formed binitric

salicylate of silver is deposited in the form of small crystalline grains.

The analysis of this salt gave the following results :—

I. 0.552 grm. of substance yielded 0.057 of water and 0.504 of carbonic acid.

II. 0.500 grm. of the same sample left upon calcination 0.160 of metallic silver.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.
Carbon	24.89	—
Hydrogen	1.14	—
Silver	..	32.0
Nitrogen	—	—
Oxygen	—	—
Theoretically we have :—		
C_{14}	1050.0	25.07
H_3	37.5	0.89
Ag	1350.0	32.24
N_2	350.0	8.36
O_{14}	1400.0	33.44
	4187.5	100.00

[*To be continued.*]

THE ESTIMATION OF PHOSPHORIC ACID IN ORGANIC SUBSTANCES.

By Prof. G. J. MULDER.

The difficulty of quantitatively determining phosphorus in organic compounds arises from two causes,—the quantity to be estimated is exeessively small, and the substanee often exists under a twofold form. When fibrine is dissolved in muriatic acid, and a solution of a known weight of iron and ammonia is added, perphosphate of iron and peroxide of iron are obtained. Let another quantity of fibrine be dissolved in nitric acid, and treated in the same manner as the first solution, and the amount of phosphoric acid obtained will be far greater.

This discrepancy arises out of the difference between the states in which phosphorus exists in organic bodies.

I have hitherto uniformly pursued Berthier's method for estimating phosphorus in all my researches on the compounds of animal proteine. When phosphorie acid is contained in a compound eombined with lime this method is not the most precise.

If a weighed piece of iron be dissolved in nitric acid, and a muriatic solution of fibrine, we will suppose, be added, all that is insoluble in this mixture will be precipitated by ammonia and also sulphate of lime, if that salt exist in the mixture. But, whilst the increase in the weight of the iron employed, calculated as peroxide, may exceed the amount which ean be ascribed exclusively to phosphoric acid, the increase in the second experiment, in which a nitric solution of the organie substance is mixed with the solution of iron, and precipitated with ammonia, is too small to indicate the phosphoric acid by which the nitric solution has been augmented. For instance, where a certain amount of phosphoric acid is diseharged from muriatic acid by peroxide of iron, the same amount of phosphoric acid + the phosphoric acid obtained by oxidation is produced from nitric acid. Two experiments are thus rendered inevitable, one with muriatic, the other with nitric, acid. That which the first experiment gives must be reckoned off the result of the seeond ; the remainder will be the phosphoric acid formed by oxidation by the nitric acid. Where no other compound of phosphorus than phosphoric acid is present in the eompound, the result in both experiments will be the same. But it is not every kind of iron that yields the same amount of peroxide, and this is a great inconvenience in following Berthier's process; it is always neeessary to ascertain what quantity of oxide the iron to be employed will yield.

The iron I have lately used furnished 142.3 Fe_2O_3.

Where neither phosphorus nor phosphoric acid is present in an organic body, as, for instance, in vegetable gelatine or horn, the nitric and muriatic solutions are not found to vary in their results.

Cascine always furnishes the same increase of the iron in weight, calculated as oxide, from a muriatic as from a nitric solution, which is a testimony in favour of the method of Berthier. The proportion of phosphoric acid, ealculated from both precipitates, is in each case 3.5 per cent. But now with albumen the result furnished by the muriatic solution differed from that of the nitrate. In this case the muriatic solution gave 0.35 per cent., the nitric solution gave 0.78 per cent., of phosphorus as phosphorie acid, whilst 0.43 per cent. must have been oxidized by the nitrie acid. So, also, albumen obtained from blood gave 0.37 from the muriatic solution, and 0.70 phosphorus from the nitric solution. Muriatic solution of fibrine again gave 0.33 and the nitrate solution 0.66 per cent. phosphorus. This is a very striking difference, for which I ean only account by the fact that the phosphorus is contained in organic compounds in different states.

Should it be alleged that muriatic acid is unable to dissolve all the phosphate of lime, or entirely to disorganize a compound of phosphoric acid with organic substances, I point to cascine as an instance of the contrary fact; in this case muriatic and nitric acids give the same results. It is, therefore, necessary to make a distinction between the phosphoric acid which exists as such in organic compounds and that which results from the action of nitric acid. Phosphoric acid, existing as such, cannot be determined by burning ; this was long ago proved by Baumhauer, for in the combustion of vitelline 3 per eent. of phosphoric acid was volatilized. Vitelline yielded, on treatment with nitric acid, 3 per cent. of phosphorus, but left on burning only 0.3 of ash. 0.166 gramme of calcined phosphoric acid, mixed in a porcelain crucible with 0.895 gramme of lampblack, and heated to redness, only left 0.109 residue. The quantity of phosphorie acid can never be ascertained from the amount of ash unless there is sufficient base present to combine with it.

Baumhauer proposed and employed a method of estimating the phosphoric acid by precipitation with peroxide of iron and ammonia, afterwards dissolving the peroxide of iron in acetic acid, and weighing only the perphosphate of iron. Were not perphosphate of iron soluble in acetic acid this would be a very good method. That it is soluble any one may eonvince himself by adding ammonia to the persulphate, the pernitrate, or, better, the perchloride of iron, and then adding acetie acid to dissolve the precipitate. When phosphoric acid is gently dropped into the solution the precipitate falls down in great abundance ; after some time it disappears, and cannot be detected on a filter. When, also, we add ammonia to a mixture of nitrate of iron and phosphoric aeid, and then add acetic aeid, we shall have a considerable loss ; and when a little iron is employed we shall have nothing on the filter. This method of Baumhauer is utterly unavailable. Fresenius directs to determine the amount of phosphoric acid by precipitating it as ammonio-phosphate of magnesia, and calculating its amount from the pyrophosphate of magnesia ; this is a very excellent means of estimating this acid, but it is still uncertain whether this process can be applied to the investigation of organic substances in which phosphorus may be present. Norton estimated the phosphoric acid as phosphate of baryta, and thus obtained some very good results; but in this process some of the earbonate of baryta is simultaneously precipitated by the ammonia, which may, in organic analyses, give rise to serious errors.

When to a solution of albuminous substances in muriatic or nitric acid, ehloride of barium is added, and the mixture filtered, and ammonia added by degrees to the filtrate, phosphate of baryta is preeipitated. After ignition this salt is $2BaO, PO_5$. This method, followed with due care, is as good as Berthier's ; but I recommend the adoption of the latter when phosphoric acid occurs only in small quantities.—*Jour. für Prakt. Chem.*, xlv., p. 282.

ON THE PREPARATION OF VITRIABLE PIGMENTS.

By Dr. A. WÄCHTER.

It eannot be said that the art of painting with vitriable pigments has at all kept pace with the progress of science, nor that it has attained that degree of excellence of which it is susceptible. Too many difficulties yet remain to allure the artist into this field, and thus its products have never risen to that estimation in art which the beauty and indestructibility of the colours deserve. This fact must be accounted for by the circumstance that the preparation of good pigments is a mere work of chance ; and, although many papers of more or less pretensions have been published on the subject, the key of the art is still in the hands of a very few individuals. Even in the generally valuable treatise of Brogniart on the "Art Ceraunique" the chapter on the preparation of colours is written with so much reserve as to be very unsatisfactory, and ean hardly be said to be a frank revelation of the knowledge he must have required at Sèvres. Nevertheless, it is important alike to science and art that the greatest possible number of persons should concur to promote the perfection of this beautiful art ; but so long as every person about to engage in the subject finds himself driven, as I was in the commencement of my investigations, to procure the knowledge acquired by others, not merely at the fair price of close study, but by the exercise of all kinds of ingenuity, to arrive at the elements of this education, in consequence of the exclusiveness of those actually engaged in the pursuit, few, I apprehend, will be at the trouble to overcome all these obstacles, while the scientific ehemist is almost inevitably shut out from the investigation of the subject. The department of vitriable painting at the present day most fully developed is the art of painting on porcelain. The glaze of hard felspar porcelain, in consequence of its difficulty of fusion, permits less alteration in the tone of a colour of the easily-fused pigments than takes place in painting on glass, enamel, fayence, &c. All the colours for painting on porcelain are, after the firing, coloured lead glasses throughout, but before this operation most them are mere mixtures of a eolourless lead glass, the flux, and the pigment. In the gold colours, purple, violet, and pink, the pigments are prepared from gold, and these preparations have always been regarded as extremely precarious and troublesome. The following are my processes :—For a

LIGHT PURPLE.

I dissolve 5 grammes of tin turnings in boiling nitro-muriatic acid, and concentrate the solution in the water-bath until it eonsolidates on cooling. The perchloride of tin thus obtained, which still contains a slight excess of muriatie acid, is then dissolved in a little distilled water, and mixed with 2 grammes of a solution of protochloride of tin of 1.700 sp. gr., obtained by boiling tin turnings in excess with muriatic acid, until it has attained the requisite concentration. The mixed solution of tin I pour into a glass vessel, and gradually mix with 10 litres of distilled water. It must still contain just so much acid as will prevent all turbidness arising from the removal of oxide of tin, which is to be ascertained by taking a drop of the concentrated solution upon a glass rod, and mixing it with distilled water in a watch-glass. A limpid solution of 0.5 grm. of gold in nitro-muriatie aeid, which ought to be as neutral as possible, is poured into the tin solution, which, according to previous instruction, has been diluted with 10 litres of water, and constantly shaken the whole time. The gold solution should now be in readiness, having been previously evaporated almost to dryness in the water-bath, diluted with water, and filtered in the dark. When the gold solution is added the

entire liquid assumes a deep red colour; no precipitate, however, is formed; this falls down immediately upon the addition of 50 grammes of solution of ammonia. Occasionally no precipitate will fall; as when, by accident, the amount of ammonia was too excessive for the quantity of acid contained in the liquid, in which case the liquid forms a deep red solution, the precipitate is readily brought away by the addition of a few drops of strong sulphuric acid, and quickly subsides. No time should now be lost in pouring off the supernatant liquid, which should be replaced, five or six times, by an equal quantity of fresh spring water. The precipitate having been thus washed is collected on a filter, and, as soon as the water has completely separated by draining off, removed, while yet moist, with a silver spatula, and well worked up, by means of a spatula and grinder, upon a plate of ground-glass, with 20 grammes of lead-glass, previously ground very fine upon the same plate with water. The lead-glass is obtained by fusing together 2 parts of minium with 1 part of quartz sand and 1 part of calcined borax. The intimate mixture of gold, purple, and lead-glass is slowly dried upon the same glass plate upon which it had been mixed in a moderately warm room, carefully protected from dust, and, when dry, rubbed to a fine powder, and mixed with 3 grammes of carbonate of silver. We thus obtain about 33 grammes of light purple pigment from 0.5 gramme of gold. The same proportion of lead-glass and carbonate of silver to the gold precipitate is carried out only through a certain range of temperature within which the colour must be burnt in upon the porcelain about the fusing point of silver. To obtain the colour with a less degree of heat the amount of lead-glass added to the gold must be augmented, but that of the carbonate of silver diminished; and the same principle must be borne in mind in the preparation of pigments for glass-painting. The best purple is sometimes spoiled in the baking in the muffle. Let this take place at too low a temperature and the colour will remain brown and dull; let the temperature be too high and it will appear pale and bluish. Acid vapours, and the vapours of oxide of bismuth, have a hurtful influence upon it.

DEEP PURPLE.

The former clear, neutral, solution of 0.5 gramme of gold in nitro-muriatic acid is diluted in a glass vessel with 10 litres of distilled water, and mixed under constant agitation with 7.5 grammes of the solution of protochloride of tin of 1.700 sp. gr., prepared as before directed. The colour of the liquid is a deep brownish red; the precipitate is deposited only on the addition of a few drops of strong sulphuric acid. The supernatant liquid should be poured off and replaced several times with the same amount of fresh spring water. The precipitate that is washed is placed on a filter, and when the water is drained off it is removed while yet moist, and mixed, just as has been described for the light purple, on a glass plate with 10 grammes of the above lead-glass, dried, then reduced to a fine powder, and mixed with 0.5 gramme of carbonate of silver. The quantity of dark purple pigment thus furnished is about 13 grammes. For the same temperature of firing as was assumed in the preceding paragraph, the relative proportions of lead-glass and carbonate of silver are as stated; for lower temperatures and for glass-painting the quantity of lead-glass must be increased and that of the salt reduced.

[*To be continued.*]

ON AN ORGANIC COMPOUND CONTAINING ARSENIC PRODUCED IN THE DISTILLATION OF BUTYRATE OF POTASH AND ARSENIOUS ACID.

By Prof. WÖHLER.

In distilling a dry mixture consisting of equal parts by weight of butyrate of potash and arsenious acid the author obtained a product consisting of two liquids, the upper one almost colourless, and having an acid reaction; the subjacent one coloured nearly black by metallic arsenic, and emitting an odour reminding one of oxide of cacodyle. A large amount of mephitic gas was at the same time disengaged, and a considerable quantity of arsenic was reduced. The product was well shaken with magnesia and water, and again subjected to distillation; a heavy, oily, colourless substance then passed over with the water, which became at first orange-coloured and subsequently dark brown on exposure to the atmosphere. This substance, which had a most filthy cacodylelite odour, burnt with a white light, and gave off fumes of arsenic, but it neither underwent spontaneous ignition, nor fumed in the air. A small quantity was digested with strong hydrochloric acid, when the odour became exceedingly irritating to the eyes and lungs. From the aqueous fluid which passed over with it, and which seemed to contain a considerable quantity of the oil in solution, an abundant light, nearly white, precipitate was deposited. On adding a solution of perchloride of mercury the cacodylic odour was gone, and was replaced by an aromatic perfume like the odour of butyrone. Heat dissolved the white substance, and the mass on cooling separated in minute crystals. When the crystallized precipitate and the liquid were mixed with hydrochloric acid and zinc shavings the abominable odour of cacodyle was again perceptible.

The hydrogen also, now disengaged, filled the atmosphere with dense white vapours, and deposited an orange-coloured substance on a cold surface being placed in its current. When the mixture was distilled, a colourless, oleaginous substance, with a filthy odour, passed over, and fumed in the air: it did not ignite spontaneously. The butyrate of potash employed in these experiments was prepared by decomposing butyric ether with an alcoholic solution of potash, the ether having been previously heated nearly to boiling for several hours, to remove all traces of acetic ether.

The above experiment satisfies Professor Wöhler that in the distillation of butyrate of potash with arsenious acid a compound analogous either to cacodyle or its oxide is formed, or that these, or one of them, are generated, being modified in their products by the presence of other bodies.

The author does not propose to pursue the inquiry any further. — *Liebig's Annalen*, October, 1848.

ON THE PRODUCTS OF THE SODA MANUFACTURE.

By JOHN BROWN, Esq.

[*Continued from page* 177.]

III. This brings us to the consideration of the third division of the soda process, viz., the manufacture of soda-ash from ball soda.

The first point is to extract all the soluble matter from the balls. This is done by digestion in warm water. The vessels used for this purpose are large square iron pans, five or six of which are usually worked together. They are so contrived that the water which runs into the first pan passes through the whole six in succession. In this way a very saturated solution is obtained. From the last digester the liquor is run into a large iron vessel, where it is allowed to settle. The insoluble matter which remains in the pans is of no use, and is therefore thrown away. It is a source of great annoyance to the manufacturer, as also to the whole neighbourhood of the place where it is deposited, large quantities of sulphuretted hydrogen being evolved from it. Numerous attempts have been made to recover the sulphur from it, but without success.

ANALYSIS OF SODA WASTE.

The following analysis of fresh soda waste was made in the same way as that of the ball soda:—

1. *Sulphuric Acid.*—The waste was digested in pure muriatic acid, and, after separating the insoluble matter by filtration, the sulphuric acid was precipitated by chloride of barium.

Waste.	BaO, SO_3.	BaO, SO_3 p. c.	CaO, SO_3 p. c.
28.00	2.10	7.500	4.396
30.95	2.20	7.108	4.166

Average 4.281

2. *Sulphur.*—The sulphur was oxidized by chlorate of potash and muriatic acid, and the sulphuric acid thus formed precipitated by chloride of barium.

Waste.	BaO, SO.	BaO, SO_3 p. c.	Sulphur p. c.
27.75 gave	27.56	99.315—7.304 = 92.011	12.689
30.90 "	32.40	104.854—7.304 = 97.550	13.455
26.95 "	27.80	103.154—7.304 = 95.850	13.220
			13.182

3. *Silica and Sand.*—By dissolving the waste in strong muriatic acid, evaporating to dryness, and dissolving the residue, the silica, sand, and carbon remained as insoluble matter, the last of which was destroyed by ignition. The silica and sand were then separated by caustic potash.

Waste.	SiO and Sand.	SiO.	Sand.	SiO p. c.	Sand p. c.
50.00 gave	5.513 containing	2.640 and	2.873	5.280	5.746

4. *Peroxide of Iron.* — After separating the silica and sand, the iron was precipitated by caustic ammonia. It contained a very small quantity of alumina.

Waste.	Fe_2O_3.	Fe_2O_3 p. c.
20.00 gave	1.10	5.500
50.00 "	2.46	4.920
21.40 "	1.44	6.729

Average 5.716

5. *Lime.*—After the iron had been precipitated by ammonia, the lime was thrown down by oxalic acid.

Waste.	CaO, CO_2.	CaO.	CaO p. c.
21.40 gave	17.10	9.576	44.747
48.90 "	39.10	21.896	44.777

Average 44.762

6. *Magnesia.*—After separating the lime the magnesia was precipitated by phosphate of soda and ammonia.

Waste.	$2MgO, P^2O_5$.	MgO.	MgO.
48.90 gave	0.970	0.346	0.707

7. *Carbonic Acid.*—A quantity of the waste was put into a flask and dilute acid slowly added to it. The carbonic acid thus disengaged was passed through a solution of caustic barytes, and from the quantity of carbonate of barytes thus precipitated the amount of carbonic acid was calculated.

Waste.	BaO, CO_2.	CO_2.	CO_2 per cent.
30.80 gave	15.65	3.513	11.406
27.27 "	13.30	2.985	10.974

Average 11.190

8. *Soluble and Insoluble Salts.*—The whole of the soluble matter was extracted by water, and the residue dried at 212° and weighed.

Waste.	Insol. Matter.	Insol. Matter p. c.	Soluble Matter p.c.
71.2 gave	52.50	73.736	26.264

9. *Carbon.*—The amount of carbon was determined in the same way as in the ball soda.

Waste.	SiO Sand and Carbon.	Carbon.	Carbon p. c.
50 gave	11.552, lost on ignition	6.039	12.078
	Insoluble salts per cent.		61.658

10. *Carbonic Acid in Insoluble Salts.*

Waste.	BaO, CO_2.	CO_2.	CO_2 in Insol. Salts.
20.30 gave	15.70	3.525	10.657

11. *Lime in Insoluble Salts.*

Waste.	CaO, CO_2.	CaO.	CaO in Insol. Salts.
23.80 gave	20.90	11.704	30.448

12. *Bisulphuret of Calcium.*—A quantity of the waste was digested with muriatic acid and a lagre quantity of water, and heated till the whole of the sulphuretted hydrogen was dissipated. The sulphur which remained was then oxidized by chlorate of potash and muriatic acid, and the sulphuric acid thus formed precipitated by chloride of barium. But, as this method does not yield very accurate results, the amount of bisulphuret of calcium given below can only be considered as an approximation.

Waste.	BaO,SO_3.	Sulphur.	Sulphur per cent.	CaS_2 per cent.
35.8 gave	11.45	1.579	2.205	3.583

13. *Hyposulphite of Lime.*—About 100 grains of the waste were digested for twenty-four hours with a solution of oxalate of potash; a salt of the oxide of copper was then added, by which all the sulphur was thrown down. The precipitated sulphuret of copper was then separated by filtration, and to the filtered solution sulphuric acid was added. At first no precipitation took place; but after standing for one or two hours the solution became slightly turbid. The quantity of sulphur was, however, too small for estimation.

14. *Water.*

Waste.	Water per cent.
100 grains lost by drying at 212°	2.10
Soluble salts	26.264
Insoluble salts	73.736
	100.000

Sulphate of lime	4.281
Sulphur	13.182
Silica	5.280
Sand	5.746
Peroxide of iron	5.716
Lime	44.762
Magnesia	0.707
Carbonic acid	11.190
Carbon	12.078
Carbonic acid in insoluble salts	10.657
Lime in insoluble salts	30.448
Bisulphuret of calcium	3.583
Hyposulphite of lime	trace
Water	2.10

			Lime.	Sulphur.	Carbonic Acid.
Insoluble salts.	Carbonate of lime	24.220	13.563	..	10.657
	3CaS CaO	20.363	16.769	7.187	
	Carbon	12.709			
	Silicate of magnesia	5.987			
	Sand	5.746			
	Peroxide of iron	5.716			
Soluble salts.	Sulphate of lime	4.281	1.645		
	Hyposulphite of lime	trace			
	Bisulphuret of calcium	3.583	1.929	2.205	
	Sulphuret of calcium	8.527	6.631	3.790	
	Hydrate of lime	5.583	4.225		
	Carbonate of soda	1.309	..	..	0.533
	Water (hygroscopic)	2.100			
		100.124	44.762	13.182	11.190

As might be expected, the quantities of lime sulphur, and carbonic acid, are subject to grea variations, every sample varying to a considerable extent.

Upon examining a sample of waste three or four weeks old, I found the quantity of hyposulphite of lime to be much greater than in perfectly fresh waste. Another specimen, which had been partially exposed to the action of the atmosphere for three years, was entirely converted into sulphate of lime, sulphite of lime, and carbonate of lime, and hyposulphate of lime. Some specimens were obtained which consisted entirely of sulphate of lime, carbonate of lime, and caustic lime. These experiments are very interesting from their showing the gradual oxidation of the sulphur which the waste contains.

The waste in the soda ball consists entirely of oxysulphuret of lime (3CaS, CaO) and caustic lime. The 3CaS, CaO soon, however, decomposes, giving rise to sulphuret and bisulphuret of calcium and caustic lime. The bisulphuret of calcium, being very efflorescent, forms on the waste heap a yellow coating of small prismatic crystals. The sulphur is then further oxidized, the first products being hyposulphite and sulphite of lime: the process still continuing, hyposulphate and sulphate of lime are formed; and this oxidation goes on till sulphate of lime remains. The caustic lime is also for the most part converted into carbonate.

It would be very interesting to ascertain the exact amount of each of these substances present in waste in different stages of decomposition; but there are as yet no methods known by which sulphurous, hyposulphurous, and hyposulphuric acid can be accurately determined, especially when existing along with sulphuric acid and sulphurets, as in soda waste. Under these circumstances, it would be impossible to make a series of analyses of the waste in its different stages of decomposition upon which perfect dependence could be placed; but it is to be hoped that as the science advances these at present insuperable obstacles may be entirely removed.

The following is an analysis by Unger of a sample of waste from Cassel:—

Carbonate of lime	19.56
3CaS+CaO	32.80
Carbon	2.60
Silicate of magnesia	6.91
Sand	3.09
Iron peroxide	3.70
Sulphate of lime	3.69
Hyposulphite of lime	4.12
Hydrate of lime	11.79
Bisulphuret of calcium	4.67
Sulphuret of calcium	3.25
Sulphuret of sodium	1.78
Water	3.45
	100.31

The soda waste thus affords ample room for further researches, which, if carefully prosecuted, might yield very interesting results. But, without dwelling any longer on this subject, I pass on to the consideration of the remaining part of this division of the process, viz., the manufacture of soda-ash from the liquor containing the soluble matter extracted from the ball soda.

This liquor contains carbonate of soda, caustic soda, sulphuret of sodium, sulphate of soda, and chloride of sodium, with a little aluminate of soda, the greater part of which is, however, soon decomposed by the action of the carbonic acid of the atmosphere, carbonate of soda being formed whilst the alumina precipitates. This solution is boiled down in an iron pan until it is nearly dry.

ANALYSIS OF SODA-ASH.

The analysis of this and the remaining salts was made in the following way:—

1. *Carbonate of Soda.*—The amount of carbonate of soda was determined by ascertaining the weight of the carbonic acid which was evolved on the addition of muriatic or sulphuric acid to the salt.

2. *Sulphuret of Sodium.*—The amount of sulphuret of sodium was ascertained by passing the gases evolved on the addition of muriatic acid to the salt through a solution of arsenious acid in caustic potash. The sulphuret of arsenic thus formed was precipitated by neutralizing the potash with nitric acid; it was then thrown on a filter, dried at 212°, and weighed. From its weight the quantity of sulphuret of sodium was calculated.

3. *Hydrate of Soda.*—To ascertain the quantity of hydrate of soda, a portion of the substance was heated strongly with carbonate of ammonia in order to convert the hydrate and sulphuret into carbonate. The amount of carbonic acid was then determined as formerly, and the difference between the results of the two experiments gave the amount of carbonic acid equivalent to the quantity of soda existing as hydrate and sulphuret in the sample. The amount united to sulphur was then deducted, and the remainder gave the per centage of hydrate.

4. *Sulphate of Soda.*—A portion of the salt was dissolved in a pretty large quantity of water, and nitric acid added to expel the carbonic acid. The sulphuric acid was then precipitated by chloride of barium.

5. *Sulphite of Soda.*—The salt was boiled with strong nitric acid in order to oxidize the whole of the sulphite of soda and sulphuret of sodium. Water was then added, and the sulphuric acid precipitated by a salt of barytes. From the quantity of sulphate of barytes thus obtained the amount got by the former experiment was deducted, and the remainder showed the quantity of sulphate of barytes equivalent to the amount of sulphite of soda and sulphuret of sodium. The per centage of sulphuret of sodium being known, the sulphite of soda was easily determined.

6. *Chloride of Sodium.*—After expelling the carbonic acid by nitric acid, the chlorine was precipitated by nitrate of silver.

7. *Aluminate of Soda and Insoluble Matter.*—A solution of the salt was acidified by muriatic acid, and the insoluble matter (principally sand) separated by filtration. From the filtered solution the alumina was precipitated by caustic ammonia.

The salt obtained by evaporation from the liquor from the leaves, after drying at 212°, yielded on analysis:—

	I.	II.
Carbonate of soda	68.907	65.513
Hydrate of soda	14.433	16.072
Sulphate of soda	7.018	7.812
Sulphite of soda	2.231	2.134
Hyposulphite of soda	trace.	trace.
Sulphuret of sodium	1.314	1.542
Chloride of sodium	3.972	3.862
Aluminate of soda	1.016	1.232
Silicate of soda	1.030	0.800
Insoluble matter	0.814	0.974
	100.735	99.941

This salt is then introduced into a reverberatory or carbonating furnace, where it is strongly heated. In this process the sulphuret of sodium is converted into sulphate of soda, and part of the hydrate of soda into carbonate. The salt when removed from the furnace is ready for the market. In Newcastle and some other places it is dissolved and carbonated again, and when thus manufactured it contains less caustic soda.

Soda-ash thus prepared contains from 48 to 53 per cent. of available alkali, that is, alkali combined with carbonic acid and water, and yielded on analysis:—

	I.	II.	Analysis of Ash from Germany, by Unger.
Carbonate of soda	71.614	70.461	62.13
Hydrate of soda	11.231	13.132	17.20
Sulphate of soda	10.202	9.149	8.66
Chloride of sodium	3.051	4.279	3.41
Sulphite of soda	1.117	1.136	0.35
Aluminate of soda	0.923	0.734	1.11
Silicate of soda	1.042	0.986	2.56
Sand	0.316	0.464	0.62
Water	..	..	3.96
	99.496	100.341	100.00

THE CHEMICAL TIMES.

SATURDAY, FEBRUARY 10, 1849.

ON THE DEFECTIVE STATE OF OUR LEGISLATION IN MATTERS CONCERNING HEALTH AND LIFE.

ANY intelligent foreigner who has resided some time in England must be struck with the tender care with which our Legislature and tribunals watch over the rights of property, and the supineness and indifference with which practices even the most pernicious to health and life are mostly regarded by them.

Two parties are accused of having transferred

the Goldsmiths'-hall mark from the genuine to an inferior article; they offer bail to any amount—in vain—their application is sternly refused. A coroner's jury returns a verdict of "Guilty of manslaughter" against an individual, and the coroner issues his warrant for the apprehension of the accused, who very wisely keeps out of the way, and applies through his legal adviser to be admitted to bail. *His* application is, *of course*, at once acceded to: he has violated none of the laws of property, and justice feels not called upon, therefore, to treat him with any degree of severity, but deems it rather her duty to extend every possible indulgence to him.

The same rule obtains throughout in all cases where health and life alone are concerned. How often have not our columns reported cases of wilful or accidental poisoning, the recurrence of which a few stringent enactments, vigorously carried out, would have effectively precluded? But of all our legislators there is not one who dreams of bringing forward some comprehensive measure to put a stop to the open and unrestricted sale of poisons.

In another part of our columns will be found a case of poisoning with comfits, coloured with arsenite of copper. This case was communicated to the *Times* by Dr. Walter Fergus, the resident medical officer at Marlborough College. It appears that three children who had eaten part of a green flower, made of sweet paste, and which had formed one of the ornaments of a large cake, were suddenly seized with vomiting, purging, and great prostration.

Dr. Fergus, who happened to be in the house at the time the children were seized with this attack of illness, felt at once strongly impressed that they had partaken of something poisonous. He made inquiries, and found that his little patients had eaten part of a green-coloured paste flower.

The nature of the symptoms and the attendant circumstances seemed to point strongly to arsenic as the cause of the attack; and indeed, upon investigation, Dr. Fergus found that the flower had been coloured with arsenite of copper.

The flower had been procured from London, and, as Dr. Feegus says, it is more than probable that a large quantity of these arseniuretted sugar flowers have been manufactured.

Now, is it not disgraceful that the manufacturers of such articles should be permitted to use the most virulent poisons for colouring them? On the Continent they manage these things otherwise. In most continental states the use of any but perfectly innocuous matters for the colouring of comfits (and also of toys) is most strictly prohibited. But *our* Legislature allows people to do just as they like in such matters as long as their practices threaten simply health and life.

The same remark applies with equal force to the vile system of adulteration which is so extensively pursued in our country, and to which our Legislature opposes hardly the slightest check. This system extends into every branch of trade and commerce, and the individuals who practise it care very little whether the admixtures which they choose to employ may or may not injuriously affect the health of the consumer.

The continental Governments watch with as much (if not greater) solicitude over the public health, and everything that may exercise an influence upon it, as they do over property. In many states of the Continent (in Prussia, for instance) the adulteration of articles of consumption of any kind or description is visited with very severe penalties, of which the confiscation of the adulterated article, and a heavy fine to the state, are the mildest forms.

It is, indeed, time that we should take a lesson in this respect from some of the continental Legislatures.

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON FEB. 7, 1849 :—				
In London and vicinity, viz. :—				
Whitechapel	1			
Hackney	1	1		
Homerton	1	1		
In the country, viz. :—				
Howden Union Workhouse	1	..	4	
Oulton Workhouse	5	..	5	
Carlisle	1			
In Scotland, viz. :—				
Edinburgh	3	2		
Glasgow	45	17	13	
Eaglesham	9	6	4	
Galston	23	5	13	
Riccarton	8	1	7	
Stirling	1	1		
St. Quivox, Ayr	13	8	5	
Old Monkland	14	11	3	
Greenock	5	4	4	
Selkirk	1			
Lochwinnoch	1	1		
Loudon	1	1		
Total new cases	134	59	58	
In London and vicinity...	943	500	132	311
In the country	831	364	122	345
In Scotland	9373	4075	2799	2499
Total	11147	4939	3053	3155

MORTALITY IN THE METROPOLIS.

The number of deaths from all causes during the week ending Saturday last was 1,137, being 32 below the weekly average of 1844, 1845, 1846, 1847, and 1848. Of this number of deaths 346 were from zymotic diseases, 169 from tubercular diseases, 203 from diseases of the lungs, 116 from consumption, and 79 from pneumonia. The cases of cholera, as set forth by the authority of the Registrar-General, are as follows :—

KENSINGTON; Town.—The following ten cases, except the last, occurred in Jenning's-buildings: Son of a labourer, 14, "cholera (3 days)." Son of a labourer, 14, "cholera (3 days)." Labourer, 28, "cholera (5 days)." Son of a labourer, 6, "cholera; typhoid fever." Son of a labourer, 9, "cholera; typhoid fever." Daughter of a labourer, 14, "cholera." F. 43, "cholera; fever." Daughter of the above, 3, "cholera (11 hours)." Another daughter, 7, "cholera (5 hours)." F. 12, "cholera (4 days); typhoid fever (5 days)."

WESTMINSTER; St. John.—In Millbank prison, M. 40, "Asiatic cholera (2 days)."—Inquest (p.m.) In the same prison, St. Margaret, M. 20, "Asiatic cholera (32 hours)."—Inquest. In Westminster workhouse, F. 25, "low fever, consequent upon an attack of cholera (6 days)."

ST. PANCRAS; Camden-town.—In St. Pancras workhouse, F. 12, one of the children removed from Mr. Drouet's establishment at Tooting, "Asiatic cholera (7 days)."

HACKNEY; Hackney.—M. 4, "Asiatic cholera (27 hours);" M. 4, "cholera (8 hours);" F. 4, "cholera (58 hours)." Stamford-hill—At High-hill Ferry, F. 6, "cholera Asiatica (10 hours)." At High-hill Ferry, M. 18 months, "atrophy (6 weeks); cholera (3 days)." At High-hill Ferry, M. 34, "cholera Asiatica (56 hours)."

Mr. Montaigne, the registrar, states that "The girl mentioned above died a few doors from the house where the death of a woman occurred reported in the last weekly return. The boy is the son of the same woman, and is one of the children who were ill at the time of her death. The man was a brickmaker, who lived but a short distance from the place where the first death occurred. High-hill Ferry lies at the foot of a hill from 40 to 60 feet above the bed of the River Lea, at an angle of nearly 45°; and receives all the sewerage and surface water from it. The drainage is very bad, and the houses in which the deaths took place are of the lowest class, and generally very dirty, owing to the poverty of the inhabitants. The other parts of the district are perfectly healthy."

HOLBORN; St. Andrew, Eastern.—M. 12, "measles, consecutive fever (6 weeks); cholera (5 days)." F. 17, "cholera (4 days)." F. 30, "cholera (21 hours)." F. 13 months, "fever (1 month); cholera (5 days)."

SHOREDITCH; Haggerstone, East.—F. 39, "Asiatic cholera (27 hours)." Mr. J. Ditchman, the registrar, states that "this woman lived at No. 3, James's-place, Margaret-street; the drainage is very bad and the sewage falls into the open sewer formerly mentioned. The landlord of the houses is anxious to do all in his power to remedy the evil as soon as the commissioners of sewers lay down proper pipes to carry off the refuse." Haggerstone, West.—At St. John's-terrace, Hackney-road, wife of a silk-manufacturer, 36, "diarrhœa (3 days), cholera Asiatica (24 hours)."

WHITECHAPEL; Aldgate.—M. 21, "cholera (36 hours)," p.m.

POPLAR; Bow and Bromley.—M. 52, "Asiatic cholera (20 hours), premonitory symptoms two days previously." Inquest.—M. 52, "cholera, consecutive fever, congestion of the brain (8 days)." F. 25, "natural death, sudden, from cholera (24 hours)."

ST. SAVIOUR; St. Saviour.—F. 9, "Asiatic cholera (5 days)."

BERMONDSEY; St. Mary.—F. 12, "diarrhœa (2 days); Asiatic cholera (22 hours)."

LAMBETH; Church, Second Part.—Son of a plasterer, 5, "cholera, convulsions (32 hours)." At 84, Union-street, bootmaker, 21, "natural death—cholera induced by eating cockles (15 hours)." Inquest.

GREENWICH; St. Nicholas, Deptford.—M. 20, "cholera (26 hours);" F. 37, "cholera (12 hours)."

WANDSWORTH AND CLAPHAM; Battersea.—F. 5, "malignant cholera, consecutive fever." In the sub-district of Streatham and Tooting Graveney, and at Mr. Drouet's establishment, a nurse, aged 60, died of "typhoid fever," after an illness of one week.

THE GOLD IN CALIFORNIA.

[From the *New York Herald* of Jan. 23.]

The news which we publish to-day, being three weeks later from California, will attract the observation of the whole community. The statements confirming the vast gold discoveries

in that region, coming from our correspondent, will not only command the attention of the commercial world, but of civilization itself. We have arrived at a new period, a new era, a fresh crisis in the history of commerce, and even of civilization. A spirit is generated from those discoveries which is more active, more intense, and more widely spread than that which agitated Europe in the time of Columbus, Cortez, and Pizarro. These late accounts will be read with great interest, and we desire our readers to watch the effects which they will certainly produce on the commercial and other interests around us.

According to these recent advices the gold region of California is the most wonderful that has ever been discovered. There seems to be no doubt that in a short time—probably in less than two years—those mines can be made to produce £100,000,000 per year. The region is the most extensive of the kind in the world, being 800 miles in length and 100 in width, with every indication that gold exists in large native masses in the rocks and mountains of the Sierra Nevada. But these vast gold mines are not the only mineral discoveries that have been made. The quicksilver in the same region seems to be as abundant as the gold, so that there are approximated to each other two metals which will have a most important effect and utility in making the gold mines more valuable. Heretofore the gold and silver mines of Mexico and Peru have been valuable to Spain, because she possessed a monopoly of the quicksilver mines at Almaden, in the Peninsula. This is surpassed by California.

According to the last accounts now given to the public, emigrants were crowding in from every port of the Pacific to California—from Mexico, Peru, the Sandwich Islands, Oregon; and we have no doubt by this time the British possessions in the East, China, and everywhere else in that region, are furnishing emigrants to the wonderful regions of California. In less than a year there will probably be a population of 100,000 to 200,000 souls, all digging for gold, and capable of producing from 100,000,000 to 300,000,000 dollars' worth per annum of pure gold, to be thrown on the commerce of the world at one fell swoop. This will produce results that no one can at this time estimate.

These are the general views of the productiveness of this region, and the prospect before us for the next few years. What is to be the effect of such vast discoveries on the commerce of the world—on old communities, on New York, London, and other great commercial cities? The only common-sense mode by which we can arrive at a correct solution of this problem is to inquire and to ascertain the effect which they have already produced in California. We have seen that prices of every description of produce or manufactures have risen tremendously; and the same results, on a wider scale and on a more extended basis, will be produced by the influx annually of a hundred millions of pure gold throughout the commercial world, and particularly in this country and Europe. Such a vast addition to the gold currency of the world will at once disturb the prices and value of all productions and merchandise to a similar extent to that which we see in Monterey and San Francisco. The prices of every commodity will therefore rise extravagantly during the next few years, according to the produce of gold from that region. Now, in a rising market everything prospers; every one gets rich, civilization expands, industry increases, and all orders of society are benefited. As soon as the first crop of gold from California reaches New York, the impulse which it will give to commercial enterprise, and the advance in the price of everything which it will cause, will be tremendous. The bank currency will be expanded, for the basis will be abundant; real estate will increase in value; agricultural productions and agricultural labour will advance at once 10, 15, 20, 30, or 40 per cent., even to as great an extent, perhaps, as was witnessed when the demand came from Ireland for the food of this country to feed the starving Irish. New York and her sister cities will be the centre of all those revolutionary movements which are certain to spring from the gold productions of California on the commerce of the whole civilized world. Ship-building will increase in value; steam-boats will be wanted; the railroads projected across the Isthmus in various places in Mexico and Central America will be pushed to completion; and we should not be surprised to see an active attempt made under the auspices of the Federal Government to construct a railroad across the continent, through the South Pass, from St. Louis, or some other point on the Mississippi, to San Francisco. The discovery of these great gold mines will no doubt form the agent of the greatest revolution in the commercial centres of the world and on the civilization of the human race that has ever taken place since the first dawn of history.

These are our views, carefully deduced from common sense, and the ordinary facts recorded in history, as well as developing themselves in California. Are they extravagant? are they fanciful? We don't think they are. We think we talk soberly, religiously, and quietly. New York will henceforth, from its position to the Pacific and Atlantic Oceans, probably in less than a quarter of a century, present a population greater than that of Paris, and display evidences of wealth, grandeur, magnificence, and industry to an equal, if not greater, degree than what we see in London at this day. We expect that in the next twenty-five years we shall make as rapid a march in this metropolis, and in the neighbouring cities, as any city has done during the last twenty-five centuries. There is no necessity for all going to California. Those who remain, and will raise produce, manufacture goods, build ships, construct steam-engines, and advance the fine arts, will enjoy the benefits of those discoveries to as great an extent as those who go to the Sacramento to dig for gold. All the results of the labours of those diggers must come to this metropolis, swell its magnificence, and increase the intensity of its action in commercial affairs. Even in a political point of view the discovery of these wonderful gold mines in California, under the government of the United States, will have a wonderful and astounding effect. We should not be surprised to see in a short time all the old provinces of Mexico, as far as the Isthmus of Darien, knocking for admission into this union; while, on the other side, the British provinces of Canada, and even the Spanish island of Cuba, may be begging and praying to be let in at the same time, and be permitted to enjoy some of the vast advantages, and participate a little in the energy, which this vast confederacy will exhibit to the astonished world. When Colonel Mason, and the Government officers and troops in that region—when, also, Colonel Stevenson, formerly of this city, and the youthful men who accompanied him,—return to New York, and exhibit their thousands, tens of thousands, and hundreds of thousands of dollars, as we expect they will do in less than a year, these wonderful facts and discoveries will produce their natural and legitimate impressions on the public mind. Wait and see!

Gilding of Polished Metals.—The gilding of polished iron and steel may be readily effected by applying an ethereal solution of gold to the surface with a camel-hair pencil. The ether flies off, and leaves the surface coated with gold; it must then be polished with a burnisher. In this way any fancy device or writing may be executed on steel or iron. This species of gilding is not, however, so durable as the following:—Apply goldleaf to the surface of polished iron, steel, or copper, heated to a bluish tint, press it on gently with the burnisher, avoiding breaking or injuring the gold; again expose it to a gentle heat, and repeat the process with fresh leaves of gold, until the gilding has acquired a proper thickness; then let it cool, and polish it with the burnisher.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Jean Louis Lamenaude, of 30, Passage Toufroy, Paris, jeweller, for a new process of applying or fixing letters of metal upon glass, marble, wood, and other substances. Patent dated July 18, 1848. Enrolled August 18, 1848.

This invention relates to a new process of applying or fixing letters of metal upon glass, crystal, marble, porcelain, stone, wood, metal, or other hard and smooth surfaces, and that the compositions for fastening such letters on the surfaces of the above-named articles or materials are such as to resist the action of all changes of the atmosphere, whether in humidity or of the temperature, and such letters, when fastened on by such compositions as are herein named, are rendered perfectly firm and immovable.

The object sought to be obtained by this invention is to secure thin metallic letters on smooth surfaces, without the use of metallic fastenings, such as riveting, bolting, screwing, or by the use of wire in any way. The letters which the patentee uses, and which he recommends, are cut out of thin sheet metal, either of silver, brass, copper, zinc—or if made of either of the simple metals, or by the electro-galvanic process, simply on sheet metal—or letters having a thin metallic base and an enamelled surface. These letters he affixes on the surface of the polished materials mentioned, by means of certain glutinous compositions, dissolved or mixed with various solvents, the proportions of which are as follows:—

First Composition.

	Parts.
Copal varnish	15
Fat oil—say linseed oil—litharge (commonly called drying oil)	5
Oil of turpentine	3
Essence of turpentine	2
Animal glue (called nerve glue, or what is termed in French "rollt de nerf") dissolved in a water-bath	5
To which add hydrate of lime	10
Total	40

Second Composition.

	Parts.
Sandarac and galipot rosin varnish (the peculiar kind of rosin used in what is termed in French "galipot")	15
Drying oil (linseed oil litharge)	5
Oil and essence of turpentine, mixed	5
Marine glue	5
Having mixed these ingredients, add Spanish white and dry white lead	10
Total	40

Third Composition.

	Parts.
Copal varnish and gum lac, mixed	15
Drying linseed oil	5
Solution of indiarubber or gutta percha	3
Oil of tar	7
Roman cement and plaster of Paris, in a powder, mixed	10
Total	40

Fourth Composition.

	Parts.
Copal varnish and colophant rosin	15
Oil and essence of turpentine	5
Isinglass, in powder	2
Iron filings, sifted, and blacksmiths' cinders	3
Washed earth, or ochre, or rotten stone	10
Total	35

What he claims as his invention is:—First, the securing or fixing of the metallic letters on glass, marble, stone, porcelain, wood, metal, or any other hard and smooth surface, without the use of metallic fastenings.

Secondly, the making the letters of metal, and coating of such letters with an enamelled surface,

of any colour. Also letters made by the electro-galvanic process, or letters gilded by the electro-galvanic process, and fixing the same by the compositions herein named.

Thirdly, the compositions as named in this specification, as applicable to fixing letters on the surface of the above-named material.

He does not confine himself to the precise proportions or quantities of the composition, as the same may require to be varied in accordance with the climate, or some other local cause; but he also claims as new the various materials in the compositions, with their solvents, in any proportions, as applied to the purposes of affixing letters on the polished surfaces of the materials herein named.

John King and Henry Medhurst, of Banksidc, for improvements in gas-meters. Patent dated July 26, 1848. Enrolled Jan. 26, 1849.

This specification relates to the construction of gas-meters, and is divided into two parts, the first being improvements upon certain apparatus described under the specification of a patent granted to Joseph Gray, dated August 17, 1846. The present improvements consist in the arrangement and construction of parts of the apparatus which act upon, and which likewise are acted upon by, the diaphragms, or moving partitions of the meter, so that the flexible parts of the diaphragms shall be moved previous to the moving of the inflexible parts ; the object of this arrangement being, as stated by the patentees, greater equality and regularity in the pressure, and, consequently, of the supply of the gas to the burner ; and also greater regularity of the light itself. The axis upon which the diaphragm is fixed is placed in a vertical position, the upper end carrying a double-ended lever, one of the ends of which passes into the forked end of a vertical double lever ; the other end, which is above the fulcrum of motion, being weighted, the movement of the diaphragm backward and forward thus having the effect of oscillating the weighted lever to and fro past the vertical line. So soon as the lever has passed the vertical line the gravity of its weight carries the lever to the extremity of its motion. The weighted lever is thus always acting as a resistance to the movement of the diaphragm, thereby allowing the pressure of the gas to move first the flexible part of the diaphragm, and subsequently the inflexible part. The reverse movement of the diaphragm is precisely the same as the foregoing. Upon the other end of the double lever at the end of the axis of the diaphragm is fixed a plate, adjustable thereon, by means of a set-screw, which, by a sliding bar and another tumbling weighted lever, the induction and the eduction valves of the two chambers of the meter are opened and closed at their proper periods of time ; the sliding bar before spoken of also, by means of a driver attached to it, gives motion to a ratchet wheel upon a small axis ; and this again, by a worm, drives the ordinary registering train of wheels and dials.

The second part of the specification describes a mode of communicating motion from the axis of the ratchet wheel to the registering wheels, so that, whichever way the axis is made to move, the driving wheel shall always move in one direction. This is effected by means of a peculiar-shaped piece upon the ratchet axis, upon which are two small projections, which, as the axis revolves, allow the teeth of the wheel to pass one by one. It is not essential that the axis should wholly revolve, as the movement of a portion of a revolution would produce the same effect.

The patentee claims the general arrangement of the apparatus, as described.

Joham Arnold Sifinkamp, of Leicester-street, Leicester-square, for improvements in the manufacture of sugar from the cane. Patent dated July 18, 1848. Enrolled January 18, 1849.

These improvements in the manufacture consist in purifying or clarifying the raw sugar by filtration through cotton, or other raw vegetable material, cut or subdivided in small pieces of about one eighth of an inch in length.

The apparatus which is employed for the purpose is an open vessel, wider at the top than the bottom, having a cock at the lowest point, from which the sugar or water used is to be withdrawn immediately. Above this cock a false bottom of open or sparred work is fixed, having a coarse woollen cloth strained tight on its upper surface ; the cotton shreds are placed on this surface, and then another open-work frame on these, having also a cloth strainer on the side placed next the cotton. This loose frame is furnished with uprights, by which an occasional pressure can be exerted in order to press the cotton, as will be hereafter explained. The gloss of fresh cotton is removed previously to its being used, by soaking it in hot water, and allowing it to remain about twelve hours, when it will be ready for use. For every hundred pounds weight of raw sugar, the quantity of cotton will be about two or two and a half pounds, in a dry state ; this, when removed from the soaking-tub and squeezed with the hand, will weigh about six pounds. This is placed on the bottom of the vessel, and in order to distribute it equally over the surface water is placed in the bottom, to an extent sufficient to hold the cotton in suspension, when by drawing off the water by the cock it will settle equally on the cloth surface. For every thousand pounds of raw sugar he uses five hundred pounds of water, and from one to two pounds of chalk in a pounded state, and about half a pound of starch (the starch not being absolutely necessary, but yet he thinks such use attended with beneficial results). This mixture is then heated to the boiling point, and allowed to boil for about eight or ten minutes, after which it is passed through a sieve, in order to remove the coarse impurities and other extraneous matters, when it is to be run into the filtering-vessel, from which it is drawn by the cock below the bottom. Should it be found that the sugar passes too quickly, and not sufficiently freed from its impurities, a slight pressure is to be exerted on the cotton shreds by means of the upper frame, as before explained, which will render it more dense, and thereby effect a more perfect filtration. This will generally be required when fresh cotton is used, as it, being light and spongy, renders the film or stratum too porous, but which will disappear after a little use. The cotton, having been long enough in the filter to be charged with the impurities of the sugar, may be removed and washed, when it will be fit for use a second time.

The materials employed in filtering being perfectly neutral, less uncrystallizable sugar will be produced, rendering great care necessary in the crystallizing and claying processes.

This process of filtering is similarly applied to the purifying and clarifying juice from the cane, whether such is conducted with caustic lime or with chalk. In this process the sugar is raised to the boiling point, in which state it is not liable to decomposition, which takes place from the fact of there being no fermentation (as in the wort of beer), and other acids are absorbed by the chalk, which he prefers being a little in excess. Instead of applying the cotton to the bottom of the filtering-vessel, it may be mixed and boiled with the sugar, and passed through the woollen cloth in a similar manner.

What he claims as of his invention is the using of any cotton or vegetable fibre, cut up or divided into small lengths (preferring cotton to other vegetable material), in the cleaning, purifying, and refining of sugar-cane juice, and refining raw sugar, as hereinbefore described.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING JANUARY 31, 1849.

Pierre Frederick Gougy, of Paris, in the Republic of France, gentleman, for improvements in apparatus and machinery for lifting and moving heavy bodies, and for raising and displacing fluids. Patent dated January 27th, 1849 ; six months.

Richard Archibald Brooman, of Fleet-street, London, for certain improvements in the manufacture of artificial limbs. Patent dated January 27th, 1849 ; six months.—(Communication.)

James Green Gibson, of Ardwick, near Manchester, machinist, for certain improvements in machines used for preparing to be spun, and spinning, cotton and other fibrous substances ; and for preparing to be woven, and weaving, such substances, when spun, Patent dated January 27th, 1849 ; six months.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, for improvements in the manufacture of soap. Patent dated January 30th, 1849 ; six months.

Alexander Wilkins, brewer, and William Stacey, engineer, both of Bradford, in the county of Wilts, for a certain improvement, or improvements, applicable to the heating and boiling of liquids of any kind or description. Patent dated January 30th, 1849 ; six months.

Samuel Wellman Wright, of Chalford, in the county of Gloucester, civil engineer, for certain improvements in preparing various fibrous substances for spinning, and in machinery and apparatus connected therewith. Patent dated January 30th, 1849 ; six months.

William Kenworthy, of Blackburn, in the county of Lancaster, cotton-spinner, for certain improvements in power-looms for weaving. Patent dated January 31st, 1849 ; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, in the county of Middlesex, engineer, for certain improvements in the manufacture of glass, and in apparatus connected therewith. Patent dated January 31st, 1849 ; six months.

PATENTS RECENTLY EXPIRED.

J. Dodd, of Stafford, engineer, for certain improvements in machinery for cutting and shaping wood and other materials. Patent dated January 29th, 1835 ; expired January 29th, 1849.

B. and J. Cook, of Birmingham, brassfounders, for certain improvements in beds and mattresses. Patent dated January 31st, 1835 ; expired January 31st, 1849.

J. Bethell, of Middlesex, gentleman, for certain improvements in apparatus for driving and working under water, and inspecting from above objects which are beneath the surface of the water. Patent dated January 31st, 1835 ; expired January 31st, 1849.

THE ELECTRIC LIGHT.
MR. STAITE and M. FOUCAULT.

At a recent sitting of the Paris Academy of Sciences, M. Dumas presented a communication from M. Foucault relative to the electric light.

In every apparatus employed up to the present time it was necessary, in order to obtain a continuous light, to be constantly moving the charcoal points nearer to each other, as fast as burnt. In the apparatus devised by M. Foucault the charcoal points are made to approach each other without any assistance, so that they are constantly kept at a uniform distance from each other—a distance the most suitable for obtaining the electric light ; and, although the approaches of the charcoal points are intermittent, yet, when the apparatus is in good order, this approximation is sufficiently quick and regular to be equivalent to a continued progressive movement.

M. Foucault states that this apparatus was constructed by him eleven months since, and that he has frequently employed it for optical experiments. He forbore, however, mentioning it to the Academy until the experiments for whose purposes he had devised the instrument were finished. Perceiving in the *London Illustrated News*, of the date of Nov. 15, 1848, that Mr. Staite had invented an apparatus for electri-

cal light similar to his own, he considered it right to lay the subject before the Academy. He also requested that a commission might be appointed to examine his apparatus. M. Foucault also stated that he had no idea of contesting the merit of a discovery which he and Mr. Staite appear to have both made about the same time; the priority of which, of course, belongs to him who first made the discovery public.

SECRET POISONING.—YARM, Saturday Morning.—A horrible case of secret poisoning has been brought to light. The murderer is a railway labourer, named George Howe, whose wife, on the 11th of November last, died rather suddenly after her accouchement. She left behind her the infant she had given birth to, and a boy about four years of age. Three days after her death Howe went to live with a person named Bray, whose housekeeper was a widow named Wood. During his residence there it was ascertained that he was paying his addresses to a woman who had about £300 in the bank. He had frequently expressed a wish that the infant would die, as he could then marry the woman who had the money. A few days since he told Mrs. Wood, the housekeeper, that he was going into the country to live, that he would take his boxes away, and send for the children at night. This person, imagining that he intended to desert the children, refused to let him take his boxes away, and he went out, but returned at night, at which time Mrs. Wood was feeding the infant. Her nephew, who had gone up stairs to bed, called to her to come and fetch the candle down. The father of the child then requested her to leave the infant with him whilst she went up stairs; but, feeling suspicious of him, she refused, and took it with her, leaving the pap it had been eating on the table. The moment she came down stairs again he left the room and went to bed. Upon the woman recommencing to feed the child she observed it reject the food, and, after swallowing one or two more teaspoonfuls, it began to cry, and seemed in the most excrucieating agony. Mrs. Wood's suspicions immediately became aroused, and, having tasted the food, she found that it had a different taste to what it had when she left it before. She called up her nephew, and sent the food to Mr. Dale, a surgeon, for his inspection. That gentleman at once detected the presence of oxalic acid, in a liquid state, in the pap, and he immediately called and saw the child. The lips, mouth, and tongue were extensively blistered. Medical aid was without avail, and the child expired the day following. The father was immediately given into custody; and the evidence taken by the magistrate and coroner proved that the prisoner had purchased half an ounce of oxalic acid on the day the child was seized with illness at the house of Mr. Hodgson, a chemist and druggist. John Garbutt, the apprentice to Mr. Hodgson, identified the father as the man he had served with the poison, and added that he told him he wanted it to clean boot tops. The superintendent of police, upon examining his bedroom, found concealed between the bed and bedstead a bottle containing oxalic acid reduced to a liquid state. Mr. Dale, who made a *post-mortem* examination of the body, said that he found the intestines extensively inflamed, which had been produced by oxalic acid. Upon making an analysis of the remainder of the food, he found that it contained a large quantity of the same poison. The father was fully committed to take his trial at the next assizes for the wilful murder of the deceased.

LIVERPOOL COLLEGE OF CHEMISTRY AND MEDICAL STUDENTS.—Our attention has been called to a letter which appeared in the last *Liverpool Standard*, signed by a few of the students in the Infirmary School of Medicine. The article relates principally to some statements set forth by Dr. Scott, of the Mechanics' Institution, in a letter to Dr. Muspratt, accompanying a memorial signed by himself and other students in the above-mentioned establishment. We do not know any of the gentlemen engaged in the affair; but no doubt Dr. Scott will, in a reply, point out those students who stated that a medical man required very little chemistry. If he does this, the letter in question falls to the ground. As we have headed this article "College of Chemistry," we will again say a few words upon that invaluable institution. The session, we understand, has just closed, and there is but one opinion with regard to the efficient way in which the professor has conducted his arduous labours. All the students, Dr. Muspratt tells us, are returning in March, with others from London and elsewhere. The medical student of this town ought to be proud in having such an institution at hand; for it is the only place, from our own knowledge, where a practical knowledge of inorganic and organic chemistry can be obtained. No organic analysis or investigations are conducted in the medical schools here, and, from all we learn, very little mineral chemistry. How can students emanating from these be fit for their profession? We must ultimately have free trade in every thing, when all responsible posts will be filled by the most learned in each science. The establishment of Dr. Muspratt's college may damage the interests of other teachers in the town; but the public have nothing to do with this, as the good old maxim says, "Sacrifice the few for the welfare of the many." Dr. Muspratt's testimonials are from the most eminent chemists of the world. We never read such eulogiums; and we doubt whether another chemist in Britain can show any equally laudatory.—*Liverpool Journal.*

COMFIT POISON.—We copy from the *Times* the following statement of a case of poisoning by comfits coloured with arsenite of copper, reported by Dr. Walter Fergus, the resident medical officer at Marlborough College:—"A few days ago there was a party at a gentleman's house here (Marlborough), at which there were a number of children. A magnificent cake was a prominent object, being profusely adorned with a variety of ornaments. The cake was cut up, and the ornaments were distributed amongst the juvenile portion of the guests. The children of one gentleman carried home, amongst others, a green flower made of sweet paste in imitation of a fuchsia. On the second day after the party, shortly before one o'clock, the eldest boy, about five years old, became very sick, and was purged. In about half an hour the second boy became sick, and in a few minutes the eldest child, a girl about seven years old, was similarly seized. I happened to be in the house at the moment of seizure of the two latter, and was at once strongly impressed that they had partaken of something poisonous. Inquiries were made, and the green flower was found minus two petals and a half. The great prostration especially of the eldest boy, together with the nature of the other symptoms and circumstances, pointed strongly to arsenic as the cause of the disaster. I, therefore, immediately prepared and administered some hydrated peroxide of iron, and adopted other suitable treatment. The vomiting and prostration continued very urgent till late in the evening with the elder children. Next morning they were found very much better, and are now all convalescent. I have since submitted a fragment of the flower to the black flux and reduction test, and obtained an abundant ring of metallic arsenic in the test-tube, fully confirming the idea I at first formed that arsenite of copper was the colouring matter of the flower, and the cause of what might have been a most serious calamity. The cake was purchased at a confectioner's in the town, and the ornaments having been procured by him from London, it is more than probable that a large quantity of these arseniuretted sugar flowers have been manufactured. It is, therefore, of great importance that the public should be made aware of the risk incurred in using these and similar articles of confectionery.

MEDICAL OFFICER OF HEALTH FOR THE CITY OF LONDON.—At a meeting of the City commissioners of sewers, held on Tuesday, February 6, it was resolved, after some discussion, that the salary of Mr. Simon, the newly-appointed medical officer of health for the city of London, should be £500 per annum.

PREVENTION OF CORROSION.—The best means of preventing the corrosion of metals is to dip the articles first into very dilute nitric acid, to immerse them afterwards in linseed oil, and to allow the excess of oil to drain off. By this process metals are effectively preserved from rust or oxidation.

TO CORRESPONDENTS.

"A Country Surgeon."—The real moxa is the pith of the sunflower imbued with solution of nitre and dried. But cotton wool so treated and made into the requisite form answers quite as well. The operation of moxa-burning is much on the decline, and deservedly so.

"Mr. H. Peters."—The Winter's bark was first used by the Dutch navigator De Winter in passing through the Straits of Magellan. His crew were suffering from fever, and the ship was deficient in medicines. De Winter, by chance struck with the aromatic qualities of the plant which now bears his name, gave it a trial as a medicine, and it is said with a marvellous therapeutic result. It is now largely used by the natives of those regions; but its real efficacy has, perhaps, been overrated.

"H. B."—Communicate the whole of the particulars to us, and we will see whether we can afford you any assistance in the pursuit of your project.

"Mr. Rawdon, Glasgow."—The editor of "The Patent Journal and Inventors' Magazine" is the proper party to apply to.

"Mr. Jeremy, Swansea."—The best method of preparing pure acetic acid intended to be used as a test is as follows:—Triturate ten parts of crystallized neutral acetate of lead, together with three parts of effloresced sulphate of soda. Put the powder into a retort, and a refrigerated mixture of two and a half parts of sulphuric acid, with an equal weight of water, and distil to dryness in the sandbath. The receiver should be connected with the retort by means of a Liebig's condenser.

"Mr. Samuel Fisher, Chelsea."—The so-called Portland powder is a mixture of equal parts of gentian and birthwort-root, tops and leaves of germander, ground pine, and lesser centaury. The whole of these ingredients are reduced to powder and intimately mixed. The dose is from fifteen grains to one drachm and more, twice or three times a day. It is a reputed tonic and stomachic, and frequently exhibited in gout. It is now, however, out of fashion.

"A Subscriber."—Arsenical paste is prepared in the following manner:—Take 2 parts of white oxide of arsenic in powder, 32 parts of finely-pulverized cinnabar, and 16 parts of dragon's blood. Triturate the several ingredients separately, and keep them in separate flasks. Whenever you want to prepare the paste mix the ingredients in the proportions given, and make the mixed powder into a paste, with a solution of gum or with saliva. The arsenical paste is recommended as an application to cancerous ulcers. We are no great admirers of this medication; on the contrary, we look upon it as most dangerous, and would not venture to recommend it to any of our friends.

"Mr. W. Gregory, Hammersmith."—We are reluctantly compelled to decline your offer for the present.

"Mr. Marshall, Leeds."—"Nautical Magazine," April, 1834.

"Mr. Warrington."—The specimens have come safely to hand. They shall be arranged and disposed of according to your instructions.

"Mr. John Welden, Kennington."—The eau sans pareil is prepared best in the following manner:—Take 2 gallons of fine old honey-water, pour it into a still capable of holding four gallons, and add the thinly-pared rinds of 6 or 8 good fresh lemons, which should neither be green nor mellow ripe, since in either case the fragrance will not be fine. Add now 60 or 70 drops of fine Roman bergamot, and, having heated the apparatus well, let the whole digest for twenty-four hours, at a moderate heat. Distil off about one gallon at the heat of the water-bath. This water improves by keeping. The eau d'argent is prepared as follows:—Take the peels of three oranges and bergamots, 3 pints of brandy, 2 drachms of bruised cinnamon, a pint and a half of distilled river water, and 2½ pounds of sugar. Distil a pint of liquor from the three first, melt the sugar. Mix, strain, and bottle up. Put some silver leaf on a plate with a little of the liquid, incorporate with the aid of a fork, and put some of the mixture into each bottle.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—February 10, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture VII.

Indigo prepared according to Fritzsche's method is a coarse powder, which, especially in sunlight, presents a fine cupriferous lustre collaterally with a crystalline texture. Sublimed indigo crystallizes in four-sided prisms possessing rectangular bases. Indigo is tasteless, odourless, and remarkably indifferent; quite insoluble in alcohol and ether. Weak acids and alkalis leave it intact. Crum gives 1.35 as its sp. gr., and 290° as its subliming point. When indigo is boiled with water, holding in suspension oxide of lead, a light green solution is formed, which on cooling clouds, and on evaporating to dryness affords a yellow powder, besides other products of oxidation. When the lead compound is suspended in water, and decomposed by sulphide of hydrogen, a brownish-yellow liquid is obtained that gives, on evaporation, a resinous mass, interspersed with a crystalline body. The sulphide of lead, boiled with spirits of wine, yields a dark brown solution, which heated with water deposits a gummy substance, fusible in hot water. If the yellow lead compound be directly affused with alcohol, and then decomposed by hydrosulphuric acid, the gummy substance remains in the spirit, while, according to Erdmann, the precipitate with boiling water yields, besides a resin, a small quantity of another compound, obtainable in crystals on evaporation.

This subject requires further investigation. Mr. Danson, who is working in my laboratory, will most likely shortly ascertain the composition of the above substances. A concentrated solution of chromic acid destroys indigo, particularly in the heat, carbonic acid escapes, and oxide of chromium separates. When a weak solution of the acid is brought to the boiling point with indigo, and the whole filtered, on refrigeration isatine crystallizes:—

1 eq. indigo ..... $C_{16}H_5O_2N$
2 eq. oxygen ..... O_2

1 eq. isatine ..... $C_{16}H_5O_4N$

Isatine is obtained from alcohol in fine reddish crystals of remarkable brilliancy. It is decomposed by heat. Chlorine transforms it into chlorisatine and bichlorisatine. When dissolved in potassa it is converted into isatinic acid. Isatinate of potassa gives with soluble lead salts isatinate of lead, which with sulphide of hydrogen yields sulphide of lead and isatinic acid. On filtering, and evaporating spontaneously *in vacuo*, the acid is obtained in white amorphous flakes, perfectly soluble in cold water. When isatinic acid is boiled with hot water, and the menstruum allowed to cool, isatine crystallizes from the liquid. The salts of isatinic acid mixed with hydrochloric acid, and boiled, also give isatine. Isatinate of potassa crystallizes from an alcoholic solution in colourless opaque prisms.

Isatinate of baryta is a flaky precipitate. The acid is represented by the formula:—

$$C_{16}H_6O_5N,$$

i.e., isatine plus an atom of water.

When we employ nitric acid as an oxidizing agent for indigo interesting changes occur. Nitrosalicylic* acid was introduced in a type of substitutions in my fifth lecture. It is formed by mixing indigo gradually with hot weak nitric acid. Powdered indigo is to be added to the acid until gas ceases to escape. The liquid must then be boiled and filtered. During refrigeration the nitrosalicylic acid, mixed with resin and carbazotic acid, crystallizes in yellow needles, which are to be redissolved in boiling water, and heated with freshly-precipitated carbonate of lead. By this means the resin and carbazotic acid are separated, and the nitrosalicylate of lead remains in solution, and can be obtained in crystals by concentration.

The acid may be procured by dissolving the nitrosalicylate of lead in boiling water, treating with sulphuric acid, and filtering. The filtrate on evaporation affords crystals of nitrosalicylic acid. If they are not quite white, edulcoration with a little weak nitric acid will purify them. They possess a bitter astringent taste, and redden litmus. When cautiously heated they melt, and sublime without suffering decomposition. The acid is not very soluble in cold, easily in hot, water, and in alcohol. Nitrosalicylic acid crystallized from water contains four atoms of water, three of which are eliminated between 150° and 230°. Formula for the acid:—

$$C_{14}H_5O_6NO_4,$$

or

$$C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5 + Aq.$$

By the action of nitric acid the nitrosalicylic acid is converted into carbazotic* and oxalic acids.

$$3(C_{14}H_5O_{10}N) + 15NO_5,$$

Nitrosalicylic acid,

equal

$$\underline{C_{12}H_3O_{14}N_3} + 15C_2O_3 + 13NO_2 + 2NO_4 + 12Aq.$$

Carbozotic acid.

Hot sulphuric acid forms a brownish liquid with the nitrosalicylic acid, from which water precipitates brown flocculi. Weak hydrochloric and sulphuric acids leave the acid intact. The nitrosalicylic acid expels carbonic acid from its combinations. Its salts possess a yellow colour and taste somewhat bitter. They inflame when heated, and burn like gunpowder. Their solutions impart a red colour to the sesquisalts of iron, but they do not affect the protosalts. I shall set before you the formulæ of a few of its compounds:—

Nitrosalicylate of ammonia	$NH_4O, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5$
Nitrosalicylate of potassa.....	$KO, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5$
Nitrosalicylate of baryta	$BaO, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5+5Aq$
Nitrosalicylate of lead	$PbO, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5+Aq$
Nitrosalicylate of silver.....	$AgO, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_5$

There are also basic salts with baryta and lead. We now enter upon the carbazotic, which you have heard is formed from the preceding acid. It is readily prepared by cautiously adding indigo, to prevent explosions, to strong nitric acid. The mixture may be boiled, if requisite, with more acid till nitrous fumes cease to escape. On cooling the carbazotic acid crystallizes. It is best purified by dissolving in potassa, precipitating by nitric acid, and recrystallizing from hot water. The crystals are only slightly soluble in cold, difficultly in boiling, water. Their solution has a dark brownish-yellow colour, and an intensely bitter taste. They are readily soluble in ether and alcohol; nitric and other mineral acids also dissolve them. Schunck found that the carbazotic acid, when heated gently in the air, gave first a brownish-yellow liquid, no decomposition occurring. As the heat augmented, a thick yellow vapour arises of a stifling nature. They communicate to the throat *a most astringent* sensation. When the acid is rapidly heated it deflagrates. According to Wöhler, carbazotic acid with peroxide of manganese and sulphuric acid eliminates nitrous acid. It suffers no decomposition with aqueous chlorine, aqua regia, and chloride of gold, but Hofmann found it converted into chloranil when acted upon by hydrochloric acid and chlorate of potassa. The salts of this acid are crystallizable. They possess a sharp taste, and explode in the heat very readily; more vehemently in a closed vessel. The potassa salt has been successfully administered in intermittent fever.

I shall place before you the formulæ of some of the leading salts of this acid:—

Carbazotate of potassa ..$KO, C_{12}\left\{\begin{matrix}H_2\\3NO_4\end{matrix}\right\}O_3$
Carbazotate of soda ....$NaO, C_{12}\left\{\begin{matrix}H_2\\3NO_4\end{matrix}\right\}O_3$
Carbazotate of ammonia$NH_4O, C_{12}\left\{\begin{matrix}H_2\\3NO_4\end{matrix}\right\}O_3$
Carbazotate of baryta ..$BaO, C_{12}\left\{\begin{matrix}H_2\\3NO_4\end{matrix}\right\}O_3$

There are likewise basic compounds of baryta and lead, similarly constituted to those of nitrosalicylic acid.

Carbazotic acid in alcohol is used as a test for potassa. The carbazotate of potassa being sparingly soluble is deposited as a yellow crystalline precipitate. Carbazotate of soda is very soluble, therefore the two alkalis can be easily separated by this reagent. Wöhler states that the soluble carbazotates left in contact with sulphate of iron, water, and hydrate of baryta, yield a new acid which unites with the earth. The excess of baryta he separated by carbonic acid gas, and to the supernatant liquor added acetate of lead. A dark brown lead salt was thus obtained, which, washed, decomposed by sulphide of hydrogen, repeatedly boiled, filtered, and the filtrate concentrated, afforded the acid in small brown crystalline granules, difficultly soluble in water, and imparting to it a yellow colour.

[*To be continued.*]

* Known also as anilic acid and indigotic acid.

* Described under the following names in different works:—Picric acid, nitropicric acid, nitrophenisic acid.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLV.

(LECTURE LXXIII.)

EXTRACTIVE.

SECTION III.—DIAPHORETIC, DIURETIC, ANTHELMINTIC, DEPURATIVE, ETC. ETC., EXTRACTIVES—(*Continued*).

ERGOT OF RYE.

In the opinion of a great many naturalists the ergot of rye is a species of fungus. M. de Candolle calls it Sclerotium clavus.

M. Léveillé considers it to be an abnormal development of the grain under the influence of a small fungus, of the genus Sphacelia, which springs up at the summit of the ovary before fecundation.

According to Wiggers' analysis, the ergot of rye contains:—

A peculiar fixed oil,
A peculiar crystalline fatty matter,
Cerin,
Ergotin,
Osmazone,
Mannite,
A gummous extractive matter associated with colouring matter,
Albumen,
Fungin,
Acid phosphate of potass,
Lime.

The oily matter is as thick as castor oil; it is insipid and inodorous. It is soluble in ether, and also in boiling alcohol. It is not saponifiable.

The ergotin of Wiggers is a reddish, pulverulent substance, of a bitter, slightly acrid taste, and nauseous odour. It is neither acid nor alkaline. It is insoluble in water and in ether, but soluble in alcohol; it dissolves in solution of caustic potass, but refuses to do so in the solutions of the alkaline carbonates. It dissolves also in acetic acid.

Wiggers looks upon the ergotin as the active principle of the ergot of rye. It would appear, however, from the results of the experiments of Dr. Wright, M. Bonjean, and M. F. Boudet, that the whole of the toxical properties of the ergot of rye reside in the oil, and that the

aqueous extract contains the beneficent principles of that substance.

The principal action of the ergot of rye is to solicit the contractions of the womb, in cases of difficult labour, from inertness of that organ. It is also an excellent hemostatic. The long-continued use of ergot of rye is dangerous.

The ergot of rye readily suffers alteration if it is not kept in well-stopped, dry bottles of 25 to 30 grammes capacity; it should also be thoroughly dried before it is put into the bottle.

M. Wislin advises to have recourse to Appert's method.

M. Martin immerses the thoroughly dried ergot in a solution of gum arabic, and dries it again thoroughly. He repeats the same operation two or three times. This is an excellent way to ensure the preservation of the ergot.

POWDER OF ERGOT OF RYE.

Dry the ergot of rye in the stove, and reduce it to powder, without leaving any residue.

Powder of ergot of rye should be prepared in small quantities only. It must be kept in a well-stopped flask. The best way is to prepare only as much of it at a time as may happen to be wanted for immediate use.

Medical practitioners agree generally in considering the powder as the most active preparation of the ergot of rye. It is administered in doses of 1 to 1½ grm., repeated once or twice, if necessary.

POTION OF ERGOT OF RYE.

Take of Ergot of rye in powder, 2 to 3 grammes.
Boiling water, 120 grammes.

Let the ergot infuse in the water; strain, and add

Sugar syrup, 50 grammes.

To be given in doses of one tablespoonful at a time.

Generally speaking, the infusion or the decoction of ergot of rye is preferred in cases where the stomach is weak or sick. In all other cases the fresh powder is preferred.

DECOCTUM PARTURIENS.

Take of Ergot of rye, 3 to 4 grammes.
Water, a sufficiency.

Boil, to leave 180 grammes of decoction; strain, and add

Sugar syrup, 30 grammes.

To be given in doses of one tablespoonful at a time.

Some practitioners deem the decoction more active than the infusion.

POTION OF ERGOT OF RYE.

Take of Ergot of rye in powder, 2 grammes.
White sugar syrup, 16 grammes.
Mint-water, 32 grammes.

Mix.

Divide into three portions, one to be taken every twenty to thirty minutes.

SYRUP OF ERGOT OF RYE.

Take of Ergot of rye in powder, 1 part.
White wine, 6 parts.
Sugar, 9 parts.

Let the ergot macerate in the wine for eight days; strain with expression; filter. Make a syrup with the filtrate and the sugar, by simple solution.

Dose, 50 to 100 grammes.

30 grammes of the syrup correspond to 2 grammes of ergot of rye.

OIL OF ERGOT OF RYE.

Take of Fresh powder of ergot of rye, any quantity you like.
Sulphuric ether, a sufficiency.

Treat the ergot with the smallest possible quantity of ether in the displacement apparatus; leave the liquor obtained to spontaneous evaporation.

The oil of the ergot of rye seems to be a mixture of common oil with a peculiar active principle. The latter is exceedingly liable to suffer alteration, which renders it necessary to produce the oil by the cold process, as the application of heat would be sure to spoil the product. The oil obtained by simple pressure exercises very little action upon the organism.

Dr. Wright has given the oil of ergot with success in doses of 20 to 50 drops, in a cup of tea, or in a slightly spirituous potion.

EXTRACT OF ERGOT OF RYE.

Take of ergot of rye, any quantity you like. Treat with cold water in a displacement apparatus, and evaporate in the liquid-bath to the consistence of an extract. The ergot of rye yields the one fifth of its own weight of extract.

According to M. Bonjean, of Chambery, the extract is an excellent hemostatic, and not at all poisonous, as it contains hardly traces of the oil. It acts with considerable promptness as a hemostatic, and in cases of slow and difficult labour.

It is administered in form of potions or pills, at the dose of one gramme.

When the aqueous extract of ergot is treated with alcohol, a large proportion of gummous matter separates, and the new extract produced is much more active than the original aqueous extract. Bonjean calls this alcoholic extract *ergotin*. The ergot of rye yields the one tenth of its own weight of this alcoholic extract, which M. Bonjean uses in form of potions or pills at the dose of one gramme. He prepares also a syrup with it, which he calls

SYRUP OF ERGOTIN.

Take of (Bonjean's) ergotin, 1 part.
Orange-flower-water, 3 parts.
Sugar syrup, 60 parts.

Dissolve the ergotin in the orange-flower-water, add the solution to the boiling syrup, and strain.

Thirty grammes of the syrup contain 50 centigrammes of ergotin.

ARNICA.

The flowers of Arnica montana are the only part of that plant still used in medicine. Arnica is an energetic agent; even in small doses the flowers provoke nausea, vertigo, and trembling. Medical practitioners prescribe the flowers of arnica against gout, rheumatism, paralysis, and spasms. It is also known as a popular remedy against blows, wounds, and contusions.

The flower of Arnica contains, according to the analysis of Chevallier and Lassaigne:—

A resin which exhales the odour of the flower,
Cytisin or cathartin,
Gallic acid,
A yellow colouring matter,
Gum,
Some salts.

To these constituents are to be added, according to Weber, a blue-coloured volatile oil, and, according to Bucholz, saponin.

From this analysis it would appear that cytisin is the active principle of the arnica. Now, cytisin is the matter to which the medicinal properties of senna are attributed, and there is so much difference between the action of senna and that of arnica, that it is impossible to believe that the respective actions of the two plants can be owing to the same principle. The resin may, perhaps, exercise considerable influence upon the properties of the arnica.

Arnica is used generally in infusion.

INFUSION OF ARNICA.

Take of Flowers of arnica, 2 to 3 grammes.
Boiling water, 1 quart.

Infuse, and strain the fluid through a woollen or very fine linen cloth.

Arnica is also used in powder. Reduce the whole of the flowers to powder without leaving the slightest residue, and mix the powder intimately. When the arnica is intended to be used as a sternutatory it should be reduced to a semi-fine powder only.

TINCTURE OF ARNICA.

Take of Arnica, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

F.S.A.

EXTRACT OF ARNICA.

Take of Arnica, any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

F.S.A.

100 parts of arnica yield about 10 parts of extract.

ASARUM.

(*Wild Spikenard or Foalsfoot.*)

The root of the foalsfoot (Asarum europæum) has emetic properties, and may, according to Cullen, MM. Coste and Willemet, and M. Loiseleur-Deslonchamps, be used, in doses of 1 to 2 grammes, as a substitute for ipecacuanha.

It is, however, more frequently used as a sternutatory. It forms one of the ingredients of the powder of Saint Ange.

MM. Feneulle and Lassaigne have analyzed the root of asarum. They found in it:—

A volatile oil,
An exceedingly acrid fatty oil,
A yellow matter, analogous to cytisin,
Starch,
Mucus,
Citric acid,
Some salts.

The distillation of the root of asarum with water yields three different products, viz., volatile oil, asarite, and camphor of asarum.

The volatile oil is liquid.

The asarite crystallizes in small silky needles, which have neither taste nor smell. The density of asarite is 0.95. It fuses at 158° Fahrenheit. It may be volatilized without suffering decomposition; in its volatilization it emits irritating fumes. It is soluble in alcohol, in ether, and in essential oils.

The camphor of asarum is white and transparent; it crystallizes in six-sided prisms. It fuses at 104° Fahrenheit, and solidifies at 80.6 F. It boils at 536° F. The thermometer rises speedily to 572° F., at which temperature the camphor suffers decomposition.

The camphor of asarum is composed of

$$C_8 H_{11} O_4.$$

The essential oil of asarum contains two equivalents of hydrogen and one of oxygen less than the camphor, so that the latter may be looked upon as an hydrate of the oil.

To produce the three preceding substances (the volatile oil, the asarite, and the camphor of asarum), the root of the plant should be distilled with water. The product is a milky, aromatic liquid, of acrid taste. On the surface are found floating small yellowish drops, which are gradually transformed into crystalline needles. Dissolve these crystals in alcohol, and precipitate the alcoholic solution with water; this will effect the separation of a milky matter, which will subside to the bottom of the vessel, and of a whitish crystalline mass, which will float in the liquid. Separate the crystals (which are pure asarite) from the milky sediment by decantation.

The sediment consists of a mixture of volatile oil and of camphor of asarum: the volatile oil may be removed by heat.

TINCTURE OF ASARUM.

Take of Root of asarum, 1 part.
Alcohol of 56 C. (21 Cartier), 5 parts.

F.S.A.

Four parts of alcohol would suffice to dissolve all the active part of the root.

The tincture of the leaves of asarum is prepared in the same way.

NARCISSUS PSEUDO-NARCISSUS.

We use in medicine the flowers, leaves, and roots of this plant. The flowers are most frequently employed.

They contain, according to M. Charpentier—

Gallic acid,
Mucilage,
Tannin,
Extractive,
Resin,
Hydrochlorate of lime.

According to M. Caventou, the colouring matter of the pseudo-narcissus is yellow, odorous, and of the nature of the fatty substances.

The bulbs, stalks, and flowers contain, ac-

cording to M. Jourdain, narcitin, a white, bland, transparent matter, which that practitioner holds to be the active principle of the plant. Narcitin is a deliquescent substance. It is soluble in alcohol and in vinegar. Its odour and taste are not strongly marked.

M. Deslongchamps has employed the pseudo-narcissus in powder with success, in certain diarrhœas, at the dose of four to eight grammes mixed up in 200 to 250 grammes of aromatic water.

EXTRACT OF NARCISSUS PSEUDO-NARCISSUS.

Moisten the dry flowers of the pseudo-narcissus with half their weight of alcohol of 56 C. (21° Cartier). Lixiviate with three fresh parts of alcohol; displace the alcohol by water, and evaporate to the consistence of an extract.

SYRUP OF PSEUDO-NARCISSUS.

Take of Fresh flowers of pseudo-narcissus, 1 part.
Boiling water, 2 parts.
Sugar, a sufficiency.

Let the flowers infuse in the water, add to this infusion double its weight of sugar, and make a syrup by simple solution.

This syrup is frequently given to children in hooping-cough.

VINEGAR OF PSEUDO-NARCISSUS.

Take of Fresh flowers of pseudo-narcissus, 1 part.
White vinegar, 8 parts.

Let the flowers macerate in the vinegar for some days; strain and filter.

OXYMEL OF PSEUDO-NARCISSUS.

Take of Vinegar of pseudo-narcissus, 1 part.
White honey, 4 parts.

Boil to the consistence of syrup.—(Van Mons.)

THE WALNUT-TREE.

We use in medicine several parts of the walnut-tree (Iuglans regia), viz., the leaves, the flowers, the pericarp, and the nuts.

The leaf of the walnut is regarded by some as a specific against icterus. It forms one of the ingredients of Mitté's anti-venereal remedy (a pilular extract made with the juice of equal parts of the leaves of the walnut, smallage, and menyanthes trifoliata).

The leaf of the walnut is used more particularly in scrofulous affections, internally in form of potion, extract, or syrup, externally in weak decoctions to wash and dress ulcers, and to make injections into fistular passages.

100 parts of the green leaves lose upon desiccation 53 parts.

EXTRACT OF WALNUT LEAVES.

Take of Dry walnut leaves, any quantity you like.
Lukewarm water, a sufficiency.

Operate by displacement.

One part of this extract represents four parts of dry leaves.

ALCOHOLIC EXTRACT OF WALNUT LEAVES.

Take of Walnut leaves, any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

F.S.A.

This extract is used in the hospitals of Paris.

The leaf yields one third of extract. It is advisable to add again a little alcohol towards the end of the evaporation, in order to ensure the equal distribution of the resinoïd matters throughout the whole mass of the extract.

SYRUP OF EXTRACT OF WALNUT LEAVES.

Take of Extract of walnut leaves, 13 parts.
Simple syrup, 987 parts.

Dissolve the extract in a little water, filter the solution, add the filtrate to the boiling syrup; boil up once, and strain.

The pericarp of the nut contains, according to Braconnot's analysis:—

Starch,
Chlorophyle,
An acrid and bitter matter,
Malic acid,
Tannin,
Citric acid,
Some salts.

The acrid matter is a very remarkable substance; it absorbs oxygen from the air with some avidity, forming carbonic acid, and probably also water. The filtered juice of the pericarp, which is almost colourless, acquires, upon exposure to the air, a deeper and deeper tint, and loses at the same time its bitter taste; a black pellicle forms on the surface, and continues to form afresh in proportion as the first-formed particles subside. This black, sedimentary matter, the result of the alteration which the bitter principle suffers in the process, is tasteless and inodorous. It resembles asphaltum in outward appearance. It burns without flame. It dissolves in potass, and is precipitated again from the potass solution by acids.

The pericarp of the walnut forms the basis of the celebrated anti-venereal potion or ptisan of Pollini, which enjoys considerable reputation in obstinate cases of syphilis, tetters, &c.

EXTRACT OF THE PERICARP OF WALNUTS.

Take of the green pericarp, any quantity you like. Pound in a mortar, add a little water, squeeze out the juice, and evaporate to the consistence of an extract.

The evaporation is to be conducted with great speed, on account of the facility with which the bitter principle suffers alteration. If the evaporation is not conducted with sufficient speed, the bitter principle is decomposed, a black deposit is formed, and an acid liquor remains.

The extract of the pericarp of walnuts is used as a stomachic and anthelmintic, at the dose of a few centigrammes.

BORAGE.

Borage (Borrago officinalis) contains an abundance of mucilage, and is, therefore, frequently used as a pectoral and demulcent. It enjoys, also, considerable reputation as a sudorific.

The extract of borage contains, according to Braconnot's analysis:—

Mucous matter	18
Animal substance insoluble in alcohol	13
Vegetable acid combined with potass	11
" " lime	0.5
Acetate of potass	1
Nitrate of potass	0.5

DESICCATION.

Borage is a very succulent plant, and its juice is of considerable viscidity; its desiccation requires, accordingly, great care. The principal point is to expose a large amount of surface to the air, and to turn the plant frequently on the hurdles. During moist weather the desiccation should be effected in the stove.

PTISAN OF BORAGE.

Take of Dry borage leaves, 12 grammes.
Boiling water, 1,000 grammes.

Let the leaves infuse in the water for one hour, and strain.—(Paris hospitals.)

EXTRACT OF BORAGE.

Reduce the dry leaves to a semi-fine powder, and moisten the latter with half its own weight of water at 68° Fahrenheit; after two hours' contact heap the powder lightly, and lixiviate. Heat the liquors obtained in the water-bath, strain, and evaporate to the consistence of an extract. Dry borage leaves yield about the one tenth of their own weight of extract.

BORAGE JUICE.

Pound the borage in a marble mortar, add about the one sixteenth of the weight of the plant of water, and subject to the action of the press. Should the juice still prove too viscous for filtration, heat slightly in the liquid-bath.

Borage juice is rarely used alone, but generally associated with the juice of other plants, which latter are in such cases pounded together with the borage.

SYRUP OF BORAGE.

Take of Hot clarified borage juice, 100 parts.
Sugar, 180 parts.

Make a syrup by simple solution in the water-bath.

DISTILLED WATER OF BORAGE.

Take of Borage, any quantity you like.
Water, a sufficiency.

Distil off a quantity of liquid of equal weight with the amount of borage used.

BURDOCK.

The root of the burdock (Arctium lappa) is about the only part of the plant used in medicine.

It enjoys considerable reputation as a sudorific and depurative.

We have no special analysis of this root, but we know that it contains starch, extractive matter, inulin, mucilage, and some salts. It is given almost invariably in the form of ptisan.

PTISAN OR POTION OF BURDOCK.

Take of Dry burdock-root, 16 to 32 grammes.
Boiling water, 1 quart.

Pound the root, and infuse the powder in the water.

The decoction of burdock-root contains a much larger proportion of starch than the infusion, and is less sapid and odorous than the latter preparation.

Percy recommended the leaves of the burdock for the treatment of certain ulcers. He used a mixture of equal parts of burdock juice and olive oil.

EXTRACT OF BURDOCK.

Reduce the dry root to powder, and moisten this with half its own weight of cold water. Operate by lixiviation with cold water. Heat the liquors obtained in the liquid-bath; strain, and evaporate to the consistence of an extract. The lixiviation of burdock is a difficult operation, which requires some skill and practice. The root is exceedingly viscous, and should be very lightly heaped.

100 parts of the root yield 37 parts of extract.

BARK OF THE ELM-TREE.

The bark of the elm is furnished by Ulmus campestris. We remove the outer cellular tissue, and use only the cortical layers.

The bark of the elm is used in certain chronic affections of the skin, principally in scrofulous subjects. M. Devergie prescribes it almost invariably in the form of syrup.

It contains tannin and an abundant proportion of mucilaginous principle. It constitutes a species of mucus which swells considerably in water without dissolving, and possesses all the properties of linseed mucilage.

PTISAN OF ELM BARK.

Take of Elm bark, 30 grammes.
Water, 1,250 grammes.

Boil down to 1,000 grammes.

SYRUP OF ELM BARK.

Take of Extract of elm bark, 3 parts.
Sugar syrup, 100 parts.

Dissolve the extract in water, add the solution to the syrup, and boil to 30° boiling.

Ten grammes of this syrup represent 30 centigrammes of the extract, and 1 gramme 40 centigrammes of the bark.

The syrup is administered at the dose of two to six tablespoonfuls per diem.

EXTRACT OF ELM BARK.

Take of Elm bark, any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

F.S.A.

100 parts of the bark yield 22 parts of extract.

ELDERBERRIES.

The berries of the elder (Sambucus nigra) have sudorific properties.

They contain:—

Malic acid,
A little citric acid,
Sugar,
Gum,
A red colouring matter, which turns blue when acted upon by a small, and green when acted upon by a large, proportion of one of the alkalis.

It is not known to which principle the elderberries owe their medicinal properties.

EXTRACT OF ELDERBERRIES.

Crush the berries in your hands, heat the juice in the water-bath, strain, and evaporate to the consistence of an extract.

The extract of elderberries is given as a sudorific, in doses of 2 to 8 grammes. In some instances it is found to exercise a purgative action.

SORREL.

The roots of the sorrel (Rumex acetosa) are occasionally used as a diuretic; the leaves (which contain binoxalate of potass) have cooling and slightly laxative properties.

Sorrel forms the basis of the so-called vegetable broth.

VEGETABLE BROTH.

Take of Sorrel, 120 grammes.
Chervil, 16 grammes.
Water, 1,000 grammes.
Common salt, 12 grammes.
Fresh butter, 16 grammes.

Boil the sorrel and chervil in a small quantity of water, with continual stirring. When the plants are sufficiently boiled add the remainder of the water, the salt, and the butter, and boil again.

COMMON LETTUCE.

The common lettuce (Lactuca sativa) is considered to possess sedative properties.

The juice of the common lettuce (obtained by incision) contains, according to M. Quevenne :—

A bitter principle, soluble in water and in alcohol, insoluble in ether,
Albumen,
Caoutchouc,
Wax,
An acid, of which the exact nature has not as yet been ascertained,
Some salts.

According to Aubergier it contains, besides these constituents, also mannite and asparamide.

The bitter principle is uncrystallizable when in a state of purity. The matter which Quevenne takes for caoutchouc would appear to consist simply of a mixture of resin and wax.

LACTUCA VIROSA.

Lactuca virosa possesses sedative properties like the Lactuca sativa, but it is more active than the latter.

The milky juice of the Lactuca virosa has been examined by Walz. It contains :—

Lactucin,
A fatty matter which exhales the odour of the lettuce, and is fusible at 257° Fahrenheit,
Another fatty matter which fuses at 167° Fahrenheit,
An insipid resin,
An acrid resin,
A brown matter analogous to ulmin,
Another brown matter which appears to possess some alkaline property,
Oxalic acid.

Lactucin is a crystalline substance. It has a bitter taste; it is soluble in from 60 to 80 parts of cold water; it dissolves more readily in hot water. It is soluble also in alcohol and in ether.

ALCOHOLIC TINCTURE OF LACTUCA VIROSA.

Take of Juice of lactuca virosa,
Alcohol of 86 C. (34° Cartier), of each equal parts.

Mix, and, after the lapse of a few days, filter.

This preparation would unquestionably be more efficacious if it were prepared with the rind of the plant alone.

EXTRACT OF LACTUCA VIROSA.

Pound the leaves and stalks of the plant; squeeze out the juice, and strain the latter through a linen cloth. Evaporate in the stove, on plates.

LIQUORICE.

(GLYCYRRHIZA GLABRA.)

The liquorice-root contains, according to Robiquet's analysis :—

Glycyrrhizin,
Starch,
Asparagin,
A resinous oil,
Albumen,
Some salts.

The glycyrrhizin, or sugar of liquorice, has been studied by Robiquet and Berzelius. It is obtained from the root in small, yellow, transparent plates; it has a sweet, saccharine taste, resembling that of the root. It dissolves readily in water and in alcohol; its solutions are yellow-coloured. All acids precipitate it from its solutions. The precipitates are sweet, and without the slightest acidity; they are soluble in boiling water, and from their solutions in that menstruum they precipitate again, upon cooling, in the form of a jelly. They are soluble also in alcohol. They contain a part of the acid which has served to precipitate them.

Glycyrrhizin combines also with bases; it is not susceptible of fermentation.

The following is the process of preparing glycyrrhizin :—

Add to an infusion of liquorice-root a sufficient quantity of sulphuric acid to effect the precipitation of the whole of the saccharine matter; the precipitate is a compound of the saccharine matter with the acid.

Wash the precipitate with acidulated water (to guard against solution during the process of washing), and, subsequently, with pure cold water, to remove the excess of acid. Dissolve the washed precipitate in alcohol, to remove the albumen which it contains in admixture. Add to the alcoholic solution, very gradually, as much carbonate of potass as is required for its exact saturation. Concentrate the liquid by evaporation, in order to effect the subsidence of the sulphate of potass formed. Decant the alcoholic fluid, and evaporate.

The resinous oil is the principle to which the liquorice-root owes its acridity. This matter seems to be converted in the course of time into a dry and insipid resin.

POWDER OF LIQUORICE.

Cut the root into thin slices, and reduce them to powder, leaving the fibrous parts as residue.

PTISAN OF LIQUORICE.

Take of Liquorice-root, 8 parts.
Boiling water, 1,000 parts.

Let the root infuse in the water for two hours, and strain.

EXTRACT OF LIQUORICE.

Take of Liquorice-root, in powder, any quantity you like.
Lukewarm water, a sufficiency.

Moisten the powder with half its own weight of water, and operate by lixiviation.

The liquorice-root yields about one third of its own weight of extract.

The extract prepared after this process is greatly superior to the extract of commerce. The latter has mostly been prepared by decoction, and contains a larger proportion of acrid matter; in some cases it has got partially burnt in the process. Zier mentions instances in which the one half of the saccharine principle was gone. This he attributes to fermentation of the liquors intended for the preparation of the extract, and formation of acetic acid, which forms with the glycyrrhizin an insoluble compound; this compound sticks to the boiler, burns, and suffers decomposition. The extract of commerce contains also copper which has been mechanically removed from the evaporating vessel. It is, moreover, almost invariably found adulterated with a large proportion of some inert powder.

DEPURATED (INSPISSATED) LIQUORICE JUICE.

Take of Extract of liquorice, any quantity you like.
Cold water, a sufficiency.

Place the extract on a diaphragm, and immerse this in water. The extract will gradually dissolve. Strain the solution, and evaporate to pilular consistence.

Roll the pilular mass into small cylindrical sticks on a marble slab slightly oiled, and dry the sticks in the sun or in the stove. Flavour the extract with powder of iris florentina, or with essence of anise. If you use the powder of iris, you must incorporate this with the extract a few minutes before you take the latter off the fire; if you want to flavour with essence of anise, pour a few drops of the latter in a flask, add the extract, shake the flask, and leave the matter in undisturbed contact for one or two days.

WHITE LIQUORICE PASTE.

Take of Grated liquorice-root, 1 part.
Gum arabic,
White sugar, of each 8 parts.
Orange-flower-water, 1 part.
Whites of eggs, a sufficiency.

Operate in the same way as you would for the preparation of marshmallow paste, with this difference only, that the gum is to be dissolved in the infusion of the liquorice, and not in water (as is the case in the preparation of the marshmallow paste). Use for every kilogramme of sugar the whites of twelve eggs.

Many pharmaciens omit the egg white, and form the paste into squares and cakes, like jujube paste.

BROWN LIQUORICE PASTE.

Take of Extract of liquorice, 1 part.
Pure gum arabic, 15 parts.
Sugar, 10 parts.
Extract of opium, a sufficiency.

Dissolve the extract of liquorice in 25 parts of cold water. Strain the solution, and add the gum arabic; effect the solution of the latter in the water-bath. Add now the sugar and the extract of opium (one gramme of extract of opium for every kilogramme of sugar). Evaporate with constant stirring, and, when the paste has acquired sufficient consistence, pour it out on an oiled marble slab. Cut the mass into cakes and squares, or roll it into sticks.

BLACK LIQUORICE PASTE.

Take of Extract of liquorice,
Sugar, of each 1 part.
Gum arabic, 2 parts.

Dissolve the extract of liquorice in four parts of cold water, and melt in the solution the gum and the sugar. Strain. Evaporate the liquid over a gentle fire to a firm consistence. Pour the mass on an oiled marble slab, and cut it into cakes and squares, or roll it into sticks.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ACTION OF NITRO-SULPHURIC ACID (A MIXTURE IN EQUAL PROPORTIONS OF FUMING SULPHURIC AND FUMING NITRIC ACIDS) ON ORGANIC SUBSTANCES.

By M. AUGUSTUS CAHOURS.

[*Continued from page* 190.]

BINITRO-SALICYLIC ETHER.

The binitro-salycilic acid may be etherified with the greatest facility. To produce the binitro-salycilic ether, it suffices to dissolve the acid in absolute alcohol, to keep the solution gently boiling, and to transmit through it a current of dry hydrochloric acid gas. When the alcoholic liquid is reduced by gentle ebullition to about one half its original volume, water is added; this determines the precipitation of a heavy oil, which concretes speedily. This product is now washed repeatedly with distilled water, and subsequently dissolved in boiling alcohol. Upon the cooling and spontaneous evaporation of this alcoholic solution the new product (the binitro-salicylic ether) is deposited, in the form of small brilliant tablets or scales presenting the same aspect as the binitric salicylate of methylene.

The binitro-salicylic ether fuses at a moderate temperature, and concretes upon cooling into a mass formed of fibrous crystals. If the acid has been maintained in fusion for several minutes, it remains liquid a considerable length of time, and assumes subsequently, upon solidifying, the appearance of a resin.

It forms with potass, soda, and ammonia, crystallizable salts analogous to those which the binitro-salicylate of methylene forms with these alkalis. When treated with concentrated solution of potass it suffers decomposition, and the binitric salicylate of potass is regenerated.

The analysis of the binitro-salicylic ether gave the following results :—

I. 0.544 grm. of substance yielded 0.157 of water and 0.844 of carbonic acid.

II. 0.500 grm. of the same sample yielded 0.145 of water and 0.772 of carbonic acid.

III. 0.488 grm. of the same sample yielded 45 cubic centimetres of nitrogen, at the temperature of 66.8 Fahrenheit, and under an atmospheric pressure of 759 millimetres (about 29.8), the gas being saturated with moisture.

These results, calculated in hundredths, lead to the following numbers :—

	I.	II.	III.
Carbon	42.30	42.11	—
Hydrogen	3.21	3.20	—
Nitrogen	..	..	10.76
Oxygen	—	—	—

Theoretically we have :—

C_{18}	1350	42.19
H_8	100	3.12
N_2	350	10.94
O_{14}	1400	43.75
	3200	100.00

It has been stated in a former part of this essay that, when the product resulting from the action of the nitro-sulphuric mixture upon salicylate of methylene is dissolved in boiling alcohol, yellowish scales of binitro-salicylate of methylene are deposited upon the refrigeration of the alcoholic solution. The mother liquor deposits upon evaporation a well-crystallized matter, which is purified by redissolution in small quantities of cold alcohol. The binitric salicylate of methylene does not dissolve perceptibly in that menstruum ; but the second product dissolves readily in it, and crystallizes subsequently, upon the spontaneous evaporation of the alcohol, in the form of yellowish transparent tablets.

The analysis of this product gave the following results :—

I. 0.610 grm. of substance yielded 0.090 of water and 0.740 of carbonic acid.

II. 0 518 grm. of the same sample yielded 0.075 of water and 0.625 of carbonic acid.

III. 0.500 grm. of the same sample yielded 64.5 cubic centimetres of nitrogen, at the temperature of 53.6 Fahrenheit, and under an atmospheric pressure of 754 millimetres (about 29.6), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.
Carbon.....	33.07	32.91	—
Hydrogen ..	1.63	1.60	—
Nitrogen	..	..	15.19
Oxygen	—	—	—

Theoretically we have :—

C_{16}	1200	33.45
H_5	62.5	1.74
N_3	531	14.63
O_{18}	1800	50.18
	3593.5	100.00

This product would accordingly appear to be simply the original salicylate of methylene, with three equivalents of hydrogen replaced by three equivalents of hyponitric gas. It is, however, invariably accompanied by carbazotic acid.

ACTION OF FUMING NITRIC ACID AND OF NITRO-SULPHURIC ACID UPON ANISIC ACID.

Anisic acid dissolves readily, with the aid of a gentle heat, in fuming nitric acid. The addition of water to the solution effects the precipitation of yellow flakes. These, when dried and purified, give a product possessing the composition and properties of nitranisic acid.

If, instead of operating in the manner just now described, we heat the liquid to ebullition, carbonic acid is evolved, and we obtain a complex residue, formed of two substances, of which the one is soluble in solution of potass, and has the composition of carbazotic acid. The other substance is insoluble in solution of potass, and very sparingly soluble only in water, even though boiling. It dissolves readily enough in boiling alcohol and in boiling ether, from which solutions it separates upon cooling and evaporation in the form of brilliant long needles, of a pale yellow colour. These needles fuse at 185 to 186.8 Fahrenheit. When heated slightly in a closed tube they sublimate, forming fine slender crystalline needles.

The analysis of this product gave the following results :—

I. 0.500 grm. of substance yielded 0.135 of water and 0.775 of carbonic acid.

II. 0.503 grm. of the same sample yielded 0.139 of water and 0.777 of carbonic acid.

III. 0.388 grm. of the same sample yielded forty-seven cubic centimetres of nitrogen, at the temperature of 59° Fahr., and under an atmospheric pressure of 762 millimetres (about 29.9), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.
Carbon	42.27	42.13	—
Hydrogen ...	2.99	3.06	—
Nitrogen	..	..	14.24
Oxygen	—	—	—

Theoretically we have :—

C_{14}	1050	42.35
H_6	75	3.02
N_2	350	14.14
O_{10}	1000	40.49
	2475	100.00

This substance has accordingly, it will be seen, the composition of binitranisol. I have ascertained also that it possesses equally the properties of the latter compound.

A dilute, boiling aqueous solution of potass fails to affect this product, and even in concentrated solution of potass it undergoes alteration only upon long-continued ebullition. A boiling alcoholic solution of potass, however, effects its decomposition speedily, and a sparingly soluble potass salt subsides in long, orange-coloured, crystalline needles. On decomposing this salt with nitric acid or dilute hydrochloric acid a new substance is obtained, which is sparingly soluble in water, but dissolves readily enough in alcohol and in ether, and is deposited, upon evaporation of the alcoholic or ethereal solution, in the form of long, light-coloured lamellæ. This new substance is an acid, and forms with potass, soda, ammonia, and baryta soluble and crystallizable salts.

The analysis of this new acid gave the following results:—

I. 0.600 grm. of substance yielded 0.113 of water and 0.859 of carbonic acid.

II. 0.480 grm. of the same sample yielded 0.098 of water and 0.692 of carbonic acid.

III. 0.451 grm. of the same sample yielded 58 cubic centimetres of nitrogen, at the temperature of 59° F., and under an atmospheric pressure of 762 millimetres (about 29.9), the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.
Carbon	39.04	39.31	—
Hydrogen ...	2.10	2.26	—
Nitrogen	..	..	15.10
Oxygen	—	—	—

and agree, accordingly, with the formula :—

$C_{12} H_4 N_2 O_{10}$.

We have :—

C_{12}	900	39.13
H_4	50	2.17
N_2	350	15.21
O_{10}	1000	43.49
	2300	100.00

Now :—

$C_{12} H_4 N_2 O_{10}$

is the formula of Laurent's nitrophenesic acid.

The perfect isomerism which exists between salicylate of methylene and anisic acid led me necessarily to study the action of the nitro-sulphuric acid upon the latter body. The results which I obtained differed considerably from those produced by the action of the nitro-sulphuric acid upon salicylate of methylene.

Anisic acid dissolves readily in nitro-sulphuric acid with the aid of a gentle heat; the anisic acid imparts no coloration to the nitro-sulphuric liquor. If the solution is heated over a gentle charcoal fire, a reaction ensues which manifests itself by a rather abundant evolution of gas, possessing the properties of carbonic acid. The heating is continued until the liquid commences to exhibit signs of turbidity, when it is to be taken off the fire and left to repose. Upon this it separates into two layers, of which the upper one presents the appearance of an oil, and concretes upon cooling. To isolate the new product formed, the refrigerated acid liquid is largely diluted with water ; this effects the separation of a heavy oil, which speedily concretes into a hard, light yellow mass. If 15 parts of the nitro-sulphuric liquor have been used to 1 part of anisic acid the reaction is complete.

The product formed in this reaction is perfectly insoluble in water, and may accordingly be readily freed from all adhering traces of nitric acid and sulphuric acid by repeated washing with boiling water. It dissolves readily enough in boiling alcohol, but a large portion of it precipitates again upon cooling. It dissolves much more readily in a mixture of equal parts of alcohol and ether. If the ethereo-alcoholic solution is left to spontaneous evaporation, the new product separates in the form of slightly yellowish shining tablets. If it is dissolved in cold anhydrous ether, and the solution is left to slow evaporation (the vessel being covered with a sheet of perforated paper), very slightly yellowish shining rhomboïdric tablets are deposited. It fuses at the temperature of 136.4 to 140° Fahrenheit, and sublimates unaltered when heated slowly. It dissolves unaltered in concentrated nitric acid with the aid of heat, and separates again from the solution in the crystalline form upon cooling.

It dissolves equally unaltered in concentrated sulphuric acid with the aid of a gentle heat.

The analysis of this new product gave the following results :—

I. 0.600 grm. of substance yielded 0.115 of water and 0.760 of carbonic acid.

II. 0.499 grm. of the same sample yielded 0.089 of water and 0.627 of carbonic acid.

III. 0.453 grm. of the same sample yielded 66.5 cubic centimetres of nitrogen, at the temperature of 59° Fahrenheit, and under an atmospheric pressure of 765 millimetres (about 30), the gas being saturated with moisture.

IV. 0.555 grm. of another sample yielded 0.103 of water and 0.701 of carbonic acid.

IV. 0.451 grm. of the same sample as IV. yielded 0.087 of water and 0.571 of carbonic acid.

VI. 0.366 grm. of the same sample as IV. yielded 49 cubic centimetres of nitrogen, at the temperature of 53.6° Fahrenheit, and under an atmospheric pressure of 757 millimetres (about 29.7), the gas being saturated with moisture.

VII. 0.500 grm. of a third sample yielded 0.097 of water and 0.632 of carbonic acid.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.	IV.	V.	VI.	VII.
Carbon	34.54	34.19	..	34.45	34.52	..	34.47
Hydrogen ..	2.12	1.97	..	2.06	2.14	..	2.15
Nitrogen....	..	..	17.33	..	..	17.25	..
Oxygen	—	—	—	—	—	—	—

And agree with the formula :—

$C_{14}\ H_5\ N_3\ O_{14}$.

We have :—

	I.	II.
C_{14}	1050	34.56
H_5	62.5	2.05
N_3	531	17.28
O_{14}	1400	46.11
	3043.5	100.00

This substance has, accordingly, the composition of the trinitrate of anisol. Its formula might, in fact, be expressed this way :—

$C_{14}\ H_5\ O_2$
$3(NO_4)$.

To demonstrate that such is really the constitution of the new product, I made the nitro-sulphuric liquor act upon pure anisol : I obtained a substance perfectly identical in composition and properties with that just now described.

The trinitrate of anisol does not dissolve in a very dilute solution of caustic potass, or in strongly ammoniated water, nor does it even suffer the slightest alteration if these liquids are heated to boiling. But the matter is very different if a moderately concentrated solution of caustic potass is used : in that case the trinitrate of anisol acquires an intense brownish-red colour, and suffers complete decomposition after an ebullition of a few minutes' duration. A peculiar nitrogenous acid is produced in this reaction, which forms with potass a salt very sparingly soluble in cold water. If a sufficiency of water is added to the residue to effect the complete solution of this potass salt, at the temperature of the boiling point, the salt separates again upon cooling in long needles of a gold chesnut colour; if the refrigeration is operated very slowly, these needles may acquire a length of several centimetres.

If the preceding potassa salt is treated with dilute boiling nitric acid, it yields up its potass to the latter, and a substance separates which is exceedingly soluble in boiling water, and is deposited again from the solution, upon cooling, in the form of very brilliant yellow needles.

This new substance is an acid. It may be readily purified by repeated washing with distilled water, and subsequent recrystallization. In a state of purity it possesses the following properties :—

It is but sparingly soluble in cold, but dissolves with great facility in boiling, water ; from the solution in the latter menstruum it separates again almost entirely upon cooling. It dissolves readily in alcohol and in ether. By spontaneous evaporation of the ethereal solution it is obtained in the form of small, hard, and very brilliant prismatic crystals.

Fuming nitric acid dissolves it readily, but fails to alter it, even upon ebullition.

It dissolves in a highly dilute boiling solution of potass, and forms with the latter base a salt, which separates almost entirely upon cooling.

It combines equally with soda ; the soda salt is obtained in the form of long gold-yellow needles. It is much more readily soluble than the potass salt.

With ammonia it forms a very sparingly soluble salt, which crystallizes in long orange-coloured needles.

With strontia and baryta it forms sparingly soluble salts, which crystallize in the form of fine needles of a beautiful yellow colour and silky aspect.

It dissolves also oxide of silver ; the solution, left to slow evaporation, deposits the silver salt in the form of fine orange-yellow needles.

The analysis of this new acid gave the following results :—

I. 0.465 grm. of substance yielded 0.057 of water and 0.532 of carbonic acid.

II. 0.450 grm. of the same sample yielded 0.048 of water and 0.519 of carbonic acid.

III. 0.397 grm. of the same sample yielded 63 centimetres of nitrogen, at the temperature of 59° F., and under an atmospheric pressure of 775 millimetres, the gas being saturated with moisture.

IV. 0.353 grm. of another sample yielded 0.045 of water and 0.404 of carbonic acid.

V. 0.455 grm. of the same sample as IV. yielded 71 cubic centimetres of nitrogen, at the temperature of 53.6 Fahrenheit, and under an atmospheric pressure of 761 millimetres, the gas being saturated with moisture.

VI. 0.400 grm. of a third sample yielded 0.047 of water and 0.459 of carbonic acid.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.	IV.	V.	VI.
Carbon	31.20	31.45	..	31.21	..	31.29
Hydrogen	1.36	1.19	..	1.40	..	1.30
Nitrogen	..	..	18.34	..	18.46	..
Oxygen	—	—	—	—	—	—

and agree with the formula,

$C_{12}\ H_3\ N_3\ O_{14}$.

We have :—

C_{12}	900	31.44
H_3	37.5	1.31
N_3	531	18.34
O_{14}	1400	48.91
	2868.5	100.00

Now, this is exactly the composition of carbazotic acid. As the new acid differs from the latter in the form of crystallization, point of fusion, solubility, and external characters of some of its salts, I shall regard it as isomeric with carbazotic acid, and I propose to designate it by the name "*picranisic acid.*"

In order to determine the equivalent of the picranisic acid I have analyzed several of its salts.

PICRANISATE OF POTASS.

This salt crystallizes in long needles of a gold-chestnut colour, and which under certain incidences present a metallic lustre.

I. 0.511 grm. of this salt yielded 0.167 of neutral anhydrous sulphate of potass = 0.090 of anhydrous potass ; this gives the number 2759.8 as the atomic weight of the acid. Theoretical calculation gives the number 2750.

II. 0.650 grm. of another sample yielded 0.212 of neutral sulphate of potass = 0.115 of potass. This gives the number 2745 as the atomic weight of the acid.

PICRANISATE OF BARYTA.

This salt is deposited upon the slow refrigeration of a boiling solution of it, in the form of fine, gold-yellow needles of silky aspect and lustre.

0.625 grm. of the dried salt yielded 0.244 of sulphate of baryta = 0.1598 of baryta. This gives the number 2765 as the atomic weight of the acid. Theoretical calculation gives the number 2756.

PICRANISATE OF AMMONIA.

Picranisic acid dissolves very readily in boiling ammonia ; the ammoniacal salt is deposited upon slow refrigeration of the liquid, in the form of long needles, which, in some cases, have a yellow colour slightly leaning to orange ; and present in others the beautiful red tint of bichromate of potass. A new crystallization often suffices to make the salt pass from one of these modifications to the other.

I. 0.351 grm. of the yellow salt yielded 0.079 of water and 0.377 of carbonic acid.

II. 0.370 grm. of the same salt yielded 72 cubic centimetres of nitrogen, at the temperature of 59° Fahrenheit, and under an atmospheric pressure of 762 millimetres, the gas being saturated with moisture.

III. 0.432 grm. of the red salt yielded 0.095 of water and 0.465 of carbonic acid.

IV. 0.404 grm. of the same salt yielded 77 cubic centimetres of nitrogen, at the temperature of 51.8 Fahrenheit, and under an atmospheric pressure of 762 millimetres, the gas being saturated with moisture.

These results, reduced to hundredths, lead to the following numbers :—

	I.	II.	III.	IV.
Carbon	29.30	..	29.35	—
Hydrogen	2.49	..	2.45	—
Nitrogen	..	22.86	..	22.89
Oxygen	—	—	—	—

Theoretically we have :—

C_{12}	900	29.27
H_6	75	2.43
N_4	708	22.76
O_{14}	1400	45.54
	3083	100.00

The anisic acid, although possessed of greater stability than the salicylic acid, seems yet, like the latter, incapable to resist the energetic action of fuming nitric acid and of the nitro-sulphuric mixture.

If the action of these acids upon anisic acid is carried beyond a certain limit, decomposition ensues : the carbon suffers actual combustion, and is converted into carbonic acid, whilst the residuary product, the anisol, a body of much greater stability than the anisic acid, exchanges a certain amount of hydrogen (more or less in proportion to the duration of the action) for an equivalent amount of hyponitric gas.

The subjoined table will show that there exists the most perfect parallelism between salicylic acid and anisic acid :—

SALICYLIC SERIES.	ANISIC SERIES.
$C_{14}\ H_6\ O_6$, Salicylic acid	$C_{16}\ H_8\ O_6$, Anisic acid
$C_{14}\ H_6\ O_6 - 2CO_2 = C_{12}\ H_6\ O_2$, Phenol	$C_{16}\ H_8\ O_6 - 2CO_2 = C_{14}\ H_8\ O_2$, Anisol
$C_{14}\ H_6\ O_6 + 2Cl = ClH + C_{14}\ H_5\ O_6$, Cl, Chlorosalicylic acid	$C_{16}\ H_8\ O_6 + 2Cl = ClH + C_{16}\ H_7\ O_6$, Cl, Chloranisic acid
$C_{14}\ H_6\ O_6 + 2Br = BrH + C_{14}\ H_5\ O_6$, Br, Bromosalicylic acid	$C_{16}\ H_8\ O_6 + 2Br = BrH + C_{16}\ H_7\ O_6$, Br, Bromanisic acid
$C_{14}\ H_6\ O_6 + NO_5,\ HO = 2\,HO + C_{14}\ H_5\ O_6$, (NO_4), Nitrosalicylic or indigotic acid	$C_{16}H_8O_6 + NO_5, HO = 2HO + C_{16}H_7O_6$, (NO_4), Nitranisic acid
$C_{14}\ H_6\ O_6 + 2NO_5,\ HO = 2CO_2 + 4HO + C_{12}\ H_4\ O_2$, $(2NO_4)$, binitrate of Phenol	$C_{16}\ H_8\ O_6 + 2NO_5,\ HO = 2CO_2 + 4HO + C_{14}\ H_6\ O_2$, $2(NO_4)$, binitrate of Anisol
$C_{14}\ H_6\ O_6 + 3NO_5,\ HO = 2CO_2 + 6HO + C_{12}\ H_3\ O_2$, $3(NO_4)$, trinitrate of Phenol	$C_{16}\ H_8\ O_6 + 3NO_5,\ HO = 2CO_2 + 6HO + C_{14}\ H_5\ O_2$, $3(NO_4)$, trinitrate of Anisol

ON THE PREPARATION OF VITRIABLE PIGMENTS.

By Dr. A. WÄCHTER.

[*Continued from page* 191.]

The gold precipitate from 0.5 gramme is to be prepared in the same manner as for the dark purple ; whilst moist it must be removed from the filter, and well mixed upon the glass plate with 12 grammes of lead-glass obtained by fusing minium 4 parts, quartz sand 2 parts, and calcined borax 1 part. It is next dried as before described, and reduced to powder upon a plate of glass; no silver in this case is added. The proportion of lead-glass to gold holds good for the same temperature as in the case of the two purple pigments : a lower temperature requires a larger proportion of lead-glass. A little silver added to this pigment converts the red violet into a dark purple ; when it is employed alone for glass-painting it makes a first-rate purple.

BLUE VIOLET.

The preceding gold precipitate of 0.5 gramme gold is mixed while moist in the glass plate with

10.5 grammes of a lead-glass prepared by fusing 4 parts of minium with 1 of quartz sand, drying it as before described, and then reducing it to a fine powder on the glass plate. If the pigment is to be burnt in at a lower temperature, the quantity of lead-glass must be increased. This blue-violet pigment is well adapted for mixing with blue pigment, but it is not applicable to glass-painting. For preparing good purple and violet vitrifiable pigments the most important condition is the very minute state of division of the gold in the gold precipitate, and of the latter in the lead-glass; this is effected by mixing the moist precipitate with the glass. Every possible tint of purple and violet may be produced by mixing the light purple with the dark purple, or with the red violet, or with the dark purple, in various proportions. An amaranth-red colour is furnished by the light purple without any addition of silver. This colour is seen on most of the porcelains of the last century, when the peculiar property of silver of converting the amaranth-red into a rose-red colour seems not to have been known. Dr. Richter appears, however, to have used this pigment for his purple, at the Royal Berlin Manufactory of Porcelain, at the commencement of this century; and a very beautiful rose colour may be seen on the vessels of that period.

PINK.

Dissolve one gramme of gold in nitro-muriatic acid; mix this solution with another of 50 grammes of alum in 20 litres of spring water; then mix it, constantly stirring, with 1.5 gramme of solution of protochloride of tin, sp. gr. 1.700; and add ammonia to precipitate the whole. Upon the subsidence of the precipitate, pour off the supernatant liquid, and replace it about ten times successively with a like amount of spring water; collect the precipitate, and dry at a gentle heat. This will weigh about 13.5 grammes. It must be mixed with 2.5 grammes carbonate of silver, and 70 grammes of the lead-glass described under light purple, and reduced to fine powder on a glass plate. This colour is only calculated to give a light pink ground on porcelain, and should only be applied in a thin layer, otherwise the gold comes away in the metallic state, and no colour is produced. All the above-described gold colours do not furnish red or violet glasses, as might be supposed, when fused alone, but many of them dirty brown or yellowish glasses, presenting a troubled appearance, from the separation of metallic gold and silver. To develop their beautiful tint they must be fused on a porcelain glaze on a layer which should not be too thick. The porcelain glaze is then coloured through and through, as may be seen on a fracture of the porcelain. When the layer is too thick the gold and silver separate in a metallic state, and produce either a liver colour or no colour at all.

[*To be continued.*]

DESCRIPTION OF A NEW COMPOUND OF BORACIC ACID WITH SODA; AND SUGGESTIONS ON THE PROBABLE MODE OF FORMATION OF BORACIC ACID.

By P. BOLLEY.

The author's attention was directed to this inquiry from having frequently witnessed the disengagement of ammoniacal gas when solutions of borax and chloride of ammonium are mixed. He could find no mention of this fact in any work, perhaps from its unimportance, and now offers two explanations. An exchange of base and acids may take place, and borate of ammonia and chloride of sodium be formed, from borate of soda and chloride of ammonium, the borate of ammonia parting with ammonia at a very low temperature, like other ammoniacal salts; or the chlorine of the sal-ammoniac may rob the borax of some part of its soda, and form a corresponding amount of chloride of sodium with liberation of ammonia, a larger amount of boracic acid forming a salt with the remainder of the soda. The author resolved upon testing these two suppositions, with the hope of finding the long-lost quadriborate of soda. The salts of boracic acid with soda at present known are:—NaO, BO_3; NaO, $2BO_3$ NaO, $6BO_3$. There must be some numbers missing in the series. I mixed chloride of ammonium with crystallized borax, two equivalents of the latter to one of the former, dissolved the whole, and boiled it as long as ammoniacal vapours were emitted. I then filtered, and, subsequently, slowly evaporated, the solution. This experiment I repeated several times, but each time all the first crops of crystals were borax, and as evaporation advanced, if the temperature had been too high, the solution became syrupy, and refused to deposit crystals. On very slow evaporation crystalline crusts separated at the bottom, as well as on the surface, and these agreed in external character and chemical reaction. After rinsing in water, and once recrystallizing, they were obtained nearly free from chlorine; the mother liquor always contained a large proportion of chloride of sodium. These crusts are very hard, milk-white or vitreous, brilliant, and present on the surface a number of minute accreted crystals, which exhibit a radiate structure when broken. Heat expels much water from them, but they do not puff up so much as borax. The crystals dissolve at common temperatures in from five to six parts of water. The solution gives white granular precipitates of boracic acid even with dilute nitric or sulphuric acid. This would suffice to show that the mass was no mixture of borax with free boracic acid, because in a saturated solution of borax, made at an ordinary temperature, boracic acid is not eliminated by an addition of acid; on the contrary, boracic acid is more soluble in water to which some acid has been added than in pure water. The solution of crystals has no action on turmeric or litmus paper, whereas a common solution of borax, and also a solution of boracic acid, turn turmeric paper quite brown.

The salt was decomposed in a platinum dish with recently-prepared hydrofluoric acid and sulphuric acid, and the sulphate of soda determined. The following were the results of the analysis:—

Soda	17.60	17.35	16.44	1	18.23
Boracic acid	82.40	82.65	83.56	4	81.77

The water lost by the powdered salt over sulphuric acid was 32.36, 34.0, 34.5, 34.99 per cent., which answers to—

	Calculated.	Found.
1 equiv. soda	11.92	11.50
4 equivs. boracic acid	53.46	53.88
10 equivs. water	34.62	34.62

Precipitates are furnished from the solution of the salt with all those saline solutions to which a solution of borax yields precipitates. Their colour and solubility is the same, and it is also to be noticed that on washing the precipitates furnished by heavy metallic oxides the amount of boracic acid falls off very considerably. I subjoin to this detail of experiments my view of the natural formation of boracic acid and of sassoline. I infer the formation of boracic acid from the behaviour of borax towards chloride of ammonium.

Payen has, among other modern chemists, devoted much attention to the formation of this acid in its natural state. Heretofore, as is well known, it has only been found in Tuscany, in the neighbourhood of Sienna, near Castelmona, and Sasso, and on the island volcano. Each of these places is situated in a volcanic district, and in both localities hot vapours ascend from the earth.

Payen supposes that strata of sulphuret of borax occur at some depth, that these are decomposed by percolating water from the ocean, and produce boracic acid and sulphuretted hydrogen. Part of the boracic acid sublimes, forms precipitates, and arrives at the lagoons; part of it decomposes the salts contained in the sea water and the carbonate of lime of the rock, thus liberating carbonic and muriatic acids, &c. This is building one hypothesis upon another not yet proved. Who ever found sulphuret of borax in its native state? or who, judging from its artificial preparation, would predicate the existence of all the conditions of its formation in a rare state of combination? Boracite and datolite, borates of magnesia and lime, behave towards chloride of ammonium precisely like borax, and liberate ammonia. But several other minerals, besides these and tincal, contain boracic acid, tourmaline, axinite, &c. Now, in a volcanic district the occurrence of sal-ammoniac in a native state is not at all unnatural, and the presence of one of the minerals just mentioned is all that is necessary for the production of boracic acid under these circumstances. Let excess of chloride of ammonium be present and the borax will be entirely decomposed into chloride of sodium and boracic acid, and so with the other compounds of borax. There is no difficulty in explaining the ascent of the boracic acid with the hot vapours, as this acid is readily volatilized from aqueous or alcoholic solutions with the vapours of these liquids. That boracic acid is formed according to my views appears further probable from the occurrence of ammonia in the vapours collected by Payen at Monte Rotundo, in Tuscany, where native boracic acid is found in great abundance.—*Liebig's Annalen, Oct.*, 1848.

ON HYDRATED VALERIANATE OF ZINC.

By M. G. C. WITTSTEIN.

The valerianate of zinc which remains upon the evaporation of aqueous solutions of the salt is anhydrous. If a concentrated solution of sulphate of zinc is mixed with valerianate of soda, a loose, white, scaly precipitate is obtained, which is equally anhydrous valerianate of zinc. However, if the valerianate of zinc finds itself at the moment of its formation in contact with even a comparatively small quantity of water, it combines chemically with a large proportion of the latter. If, for instance, recently precipitated and well-washed carbonate of zinc is mixed with a sufficiency of water, to form a thin paste, and the requisite quantity of valerianic acid (to be determined previously by calculation) is then added, the whole of the carbonate is speedily converted into hydrated valerianate of zinc. This new salt may be dried at 122° Fahr. without losing any of its water. There is hardly the slightest perceptible difference of appearance between this hydrated and the anhydrous salt. If the hydrated salt is exposed to a temperature of 212° Fahr. the water is gradually expelled, the salt shrinks, and there remains at last a homogeneous, resinous, dirty white anhydrous mass. In an experiment of this kind made by M. Wittstein the hydrated valerianate of zinc lost 44 per cent. of its weight; the remaining 56 per cent. gave 17 of oxide of zinc, which proved that none of the acid had been lost, since 17 of zinc requires 38.58 of valerianic acid to form the neutral valerianate of that metal. The residue contained still a trifling proportion of water.

The hydrated valerianate of zinc has accordingly the following composition:—

	Found.	Atoms.	Calculated.
Oxide of zinc	17.00	1	16.94
Valerianic acid ..	38.58	1	38.42
Water	44.42	12	44.64
	100.00		100.00

which may be expressed by the formula:—

$$ZnO, C_{10} H_9 O_3 + 12HO.$$

The hydrated valerianate dissolves more readily in water than the anhydrous. One part of hydrated salt requires forty-four parts of water for its solution. The solution of the hydrated, like that of the anhydrous, salt turns turbid when heated, and recovers its transparency upon cooling.

If the solution of the hydrated salt is boiled for some time, part of the precipitate formed during the ebullition refuses to dissolve again upon cooling. This persistent precipitate consists of an anhydrous salt, which, upon analysis, yields, however, invariably a much larger pro-

portion of oxide of zinc than corresponds to the neutral valerianate. I obtained mostly 50 per cent. and more of the oxide, instead of 30 per cent. This proves that the neutral salt suffers decomposition in the process, resulting in separation of part of the acid and formation of a basic salt of zinc. It is evidently that portion of the precipitate which subsides to the bottom of the vessel during the ebullition that suffers this decomposition. I could, however, never yet succeed to obtain it free from admixture of the neutral salt.

The formation of the basic salt during the ebullition of the solution of the neutral salt gives, as a hint, to conduct the evaporation of the solution at a gentle heat only, if we wish to obtain the neutral compound unaltered. The neutral salt remaining in solution was found to be anhydrous, a result that might have been anticipated.—*Büchner's Repertorium.*

A VIEW OF THE VARIOUS KINDS OF POLARITY,

THE OPPOSITIONS OR ANTITHESES WHICH GIVE RISE TO THAT IDEA, AND THE HYPOTHESES BY WHICH IT HAS BEEN PROPOSED TO EXPLAIN THEM.*

Polarities.	Antithesis.	Hypothesis.
Polarization of light.....	Transmission and non-transmission	(Particles with poles, or better) transverse vibrations.
Dipolarization by crystals	Complementary colours	Transverse vibrations.
Magnetism (iron, &c.) ...	Attraction and repulsion	Attraction and repulsion at a distance of (solid particles, or better) of two opposite fluids.
Terrestrial magnetism ...	Needle points N. and S. nearly	(Two poles, four poles, or better) the earth a mass of polar elements.
Electricity (induction) ..	Attraction and repulsion	Two opposite fluids, particles attracting and repelling at a distance, or action through polar contiguous particles (Faraday).
Chemical polarity, composition or systasis	Base and acid	
Chemical polarity, analysis and synthesis	Anion and cathion	Opposite motion of anion and cathion.
Galvanism.....	Zinc and copper under action of acid	Current of fluid in the wire.
Electro-magnetism.....	Magnet turns right or left by galvanic current	The magnet is composed of transverse circulating galvanic currents.
Electro-magnetic induction	Magnetism started or stopped gives galvanic current opposite ways	Galvanic current has momentum.
Electro-tonic state?		
Diamagnetism (bismuth, &c.)	Repulsion and attraction.....	Induction like magnetism (F. 2429). Two fluids?
Magne-crystallization ...	Crystalline axis directed by the magnetic line	Line of anion and cathion directed by the magnetic line?
Crystalline form	Opposite faces making the same definite angle with an axis	Elementary particles definitively arranged in space according to anion and cathion?
Dipolarization by crystals	Complementary colours	Transverse vibrations determined by crystalline axis.
Circular polarization affected by galvanic current	Deviation of plane of polarization to right and left	Circular luminiferous vibrations connected with galvanic current?
Polarization by heat	Transmission and non-transmission	Tranverse vibrations?

" See Dr. Whewell's " Lecture on the Idea of Polarity," page 172.

EXPERIMENTS ON DIAMAGNETISM.

By H. C. ŒRSTED.*

At a meeting of the Royal Society of Sciences at Copenhagen, on the 30th of June, I communicated the results of some researches I had made upon diamagnetism, an abstract of which appeared in the proceedings of the society. During the vacation I have continued my experiments, and have obtained several new results. As the memoir will not appear for many months, I have decided on giving an abstract, which may be communicated to my distant friends.

My researches relate to the celebrated diamagnetic discoveries of Mr. Faraday, and to the extensions they have received from some learned Germans.

Mr. Faraday, in the experiments with his great electro-magnet, met with a class of bodies which are repelled by the two poles of the magnet. One or two examples of this repulsion had been known for some time; but the researches of the illustrious Englishman have rendered this fact general, and of such importance as to become the object of attention of all philosophers. Brugmanns had already discovered in 1778 that bismuth is repelled by the two poles of a magnet. Becquerel, sen., again met with this repulsion both in bismuth and in antimony. Mr. Faraday found that his great electro-magnet produced this repulsion in almost all the bodies it did not attract. He discovered at the same time that long pieces thus repelled assume, under the influence of the electro-magnet, a position perpendicular to that which an attracted body would take under the same circumstances. This property he called diamagnetism.

M. Reich, of Freiburg, so well known from his beautiful experiments on the deviation in the fall of bodies from a great height, applied to the discovery of diamagnetism the observation, overlooked by other philosophers, that the two poles of the magnet employed together do not produce on these bodies a repulsion equal to the sum of the repulsions produced by each of them, but equal to their difference; so that their joint effect is null when their forces are equal. At the same time he made some experiments which seemed to indicate that the pole which repulsed the diamagnetic body produced in the parts adjacent to it a magnetic force similar to its own, but not an opposite force, as occurs in attracted bodies. Professor Weber confirmed the opinion of M. Reich* by some very elaborate researches, and showed that diamagnetic bodies acquire, under the influence of the electro-magnet, a transversal magnetism having two poles, but so placed that each of them has the same kind of magnetism as the pole nearest to the electro-magnet.

M. Poggendorff conceived some very decisive experiments, which have the advantage of proving the new view in an easy manner; and M. Plücker contributed a further experiment, which, if it did not tend to establish the view, rendered the possibility of proving it more easy.

In my experiments I made use of the large U-shaped electro-magnet of the Polytechnic School of Copenhagen, which is capable of carrying 1,400 kilogrammes.† It must, however, be remarked that it was not necessary to put all its force in activity for these experiments; but there was rarely less than half of this power made use of, although the greater part of them might have been executed with a much weaker force, even with a single element. Each extremity of the electro-magnet supports a horizontal piece of iron, which we shall call a polar piece. These polar pieces serve to give a horizontal direction to the action of the electro-magnet. It is between the two perpendicular surfaces, which face one another, that the diamagnetic body is made to oscillate. These are called polar faces. In every case, excepting those indicated, I have made use of rectangular pieces. At the commencement of my experiments I employed cylindrical pieces; but this form is less suited for discovering all the circumstances which should be taken into consideration in these investigations.

A diamagnetic needle suspended horizontally between the polar faces assumes, as is well known, an equatorial position, which is parallel to the polar faces; but, if it is raised a little above the edges of the polar faces, it takes a perpendicular direction to the prolonged polar faces. This position is at the same time axial; but it will subsequently be seen that the question here is as to its perpendicularity to the polar faces. This phenomenon is exhibited with remarkable quickness, which renders the experiment very convenient for many diamagnetic investigations. When the needle is turned from its perpendicular position it reacquires it by oscillation. Its directing force diminishes with its elevation above the polar pieces. The experiment was made with several diamagnetic bodies, with bismuth, amber, mother-of-pearl, tortoiseshell, alabaster, quills of feathers, sulphur, coal, &c.

The change of direction observed in these experiments vanishes as the polar faces are separated. At the distance of 17 millimetres the effect was still well marked; but it is very much stronger at short distances. When the distance was diminished so that the diamagnetic

* "Annales de Chimie et de Physique" and "Philosophical Magazine."

* See "Taylor's Scientific Memoirs," vol. v., part 19, p. 477.

† I have here conformed to the usual way of indicating the power of the magnet, although there is much uncertainty, as is proved by my experiments on this electro-magnet, communicated to the society in December, 1847. The object of these experiments was to ascertain the weight the electro-magnet was capable of carrying when its poles were furnished with different pieces of iron. Within certain limits the carrying force increased nearly in proportion to the mass of the keeper; but what merits most attention is, that the force of the electro-magnet expressed in weight does not follow the same relation to the electro-motive power of the galvanic apparatus, when the keeper is in contact with the electro-magnet, and when it is at a certain distance. In contact, the mean effect of each galvanic element was 712.5 kilogrammes. But two elements combined gave but 0.72 of the sum of the individual effects of the elements; three elements combined gave but 0.48; eight, 0.26; sixteen, 0.125; so that the effect of sixteen elements was only twice that of one. At the distance of 1.33 millimetre the effect of one element was only 0.178 of that of the same element in the case of contact, but the effect increased in a very different ratio with the number of the elements; in this case sixteen elements gave four times the effect of a single one. At 2.225 millimetres distance the effect of one element was only 0.051 of that produced in case of contact; but sixteen elements gave 9.4 times the effect which a single one gave. These experiments, which require much time, I intend to continue as soon as my other engagements will allow.

body could not be inserted between the polar faces, that is to say, perpendicular to them, the part of the effect which takes place above the polar faces was exhibited with considerable energy. When the diamagnetic needle was suspended above the upper edge of one of the polar faces, it equally assumed the position called axial, perpendicular to that edge, but with less force than under the influence of the two faces. On examining the position which the needle takes above the two edges of the polar piece, it is found that it everywhere assumes the position perpendicular to the edge to the influence of which it is exposed. In those cases where it is exposed to the action of two edges at once it takes the intermediary position. Above the edge of a wedge-shaped piece of iron, placed with its base on one of the poles of the electro-magnet, the needle likewise assumes a position perpendicular to this edge. On a cylindrical polar piece the needle, placed with its centre above the edge of the polar face, arranges itself perpendicular to it; but at some distance from the edge it turns and takes a perpendicular position to the line which may be drawn parallel to the axis in the more elevated part of the cylindrical surface. When a perforated cylinder is employed as a polar piece, and the diamagnetic needle is made to descend and rise alternately, and parallel to the polar face, the needle is found to leave the position parallel to the polar faces, and to assume the position called axial as soon as it is opposite the perforations. I employed for this experiment a needle of bismuth 16 millimetres in length. With two similar polar pieces the same effect is obtained, but it is much greater.

When the diamagnetic needle is suspended between the polar faces, it has, in accordance with the experiments of the German philosophers above mentioned, magnetic poles in the transversal direction, arranged in such a manner that the magnetism of each side is of the same nature as that of the pole nearest to the electro-magnet. The easiest method of observing this is that described by M. Plücker, who introduces between the polar faces, and parallel to them, a small bar of iron separated from the faces by some non-magnetic substance. As the sides of this bar acquire by the influence of the faces a of magnetism the reverse of that of the nearest face, but each side of the needle has the same magnetism as the nearest face, the needle now retained by two forces oscillates with much greater velocity than when under the influence of the polar faces only. When the diamagnetic needle is raised above a polar piece, and its direction is changed, its magnetic poles change their places at the same time.

I had been led into error at the commencement by several phenomena, which in the novelty of the investigation seemed very complicated, but which, nevertheless, appeared very simple when the law had been found for them. At first I thought that the diamagnetic needle above the polar pieces had in each extremity the opposite magnetism to that of the adjoining polar piece; for the lower part of a bar of iron, influenced by the piece, repelled the extremity of the needle which was above that piece. This effect takes place not only on placing the repelling pole of iron near to each side, but equally above and below. Nevertheless, later experiments have led me to reject the conclusion which I had previously drawn. I found that a piece of iron of moderate size receives from the polar piece acting upon it a magnetic force sufficient to repel the diamagnetic matter of the needle, notwithstanding the poles which it had received under the influence of the electro-magnet. To discover the diamagnetic poles in this case, it is necessary to employ very small pieces or blades of iron; they should not weigh more than two or three grammes. To experiment with them the easier I attached slips of zinc or pieces of wood to them. By this means I at last arrived at the conviction that the lower part of the diamagnetic needle suspended above a polar piece has the same magnetism, and that its upper portion has the opposite. In experimenting on this subject I finally made use of a thin blade of iron, shaped thus ℄, and fixed to a piece of wood. When this blade is placed on the polar piece it has in its upper part the same magnetism as the polar piece, and in its lower part the opposite. When the opening of the curve faces the needle it attracts it; but when the upper part is beneath, or its lower part above, the needle it repels it.

When the needle is suspended over one of the polar pieces, so that the prolongation of one of the perpendicular faces of the piece divides the needle into two parts, it is found that the diamagnetic poles produced by the electro-magnet extend beyond the part which is above or correspondent to the upper surface of the piece. In some experiments made with a needle of bismuth of fifty-six millimetres this effect extended to nearly fourteen millimetres.

When the needle was divided into two equal parts by the prolonged perpendicular faces, the extremity of the needle the more distant from the polar piece was not polarized.

When the electro-magnet was furnished with two polar pieces placed at a distance of 48 millimetres, I found that the same needle had diamagnetic poles in all its parts. The half of the needle which was turned towards the north pole had north magnetism at its lower edge, and south magnetism at its upper edge; the other portion of the needle had, under the influence of the south pole, the magnetism of this pole at the lower edge, and north magnetism at its upper edge. There is, therefore, opposite magnetism in the two halves of each edge, taken separately, and in each half between the two edges, the upper and lower one.

When the diamagnetic body is made to oscillate between the polar faces, it does so with greater velocity the nearer it is to one of the edges of this face. In one experiment in which the electro-magnet was excited by sixteen of Bunsen's galvanic elements, and where the distance of the polar faces was six millimetres, a needle of bismuth at an equal distance from the upper and lower edges of these faces made twenty-five oscillations in thirty seconds; but level with the edges it made a hundred oscillations in the same time. Above the polar pieces, in the axial position, the needle made only nineteen oscillations in the same time. These experiments have been sufficiently repeated and varied to afford the most perfect certainty as to what has been stated; but the investigations have not yet been carried far enough to admit of an accurate numerical law being deduced from them.

When a horizontal needle of bismuth is suspended by a fibre of silk to the extremity of a balance, so that the balance can be raised or lowered, the needle is found to be repelled with the greater force the nearer it is situated to one of the edges of the polar faces. It will be understood that this repelling power causes the needle to ascend when it is near the upper edges, and to descend when near the lower edges; in the intermediate position it neither ascends nor descends. When the needle is suspended above the polar pieces, and, consequently, in the direction perpendicular to the edges of the polar faces, it is again repelled, but much more feebly than when in the equatorial position.

Hitherto diamagnetic effects had only been observed in bodies which are repelled by the two poles of the magnet. My experiments have shown that a similar effect may be produced in most bodies which are attracted by the two magnetic poles; so that these bodies constitute a new kind of diamagnetic substances. These two classes may be distinguished by the names of repulsive and attractive diamagnetic bodies.

A needle made of a substance that is attracted by the magnet, but of which the magnetism is not of the same nature as that of iron and nickel, when suspended between the two polar faces of the electro-magnet, acquires, as is well known, the position called axial by Mr. Faraday; but if it is raised above the upper edges, or lowered beneath the lower edges of the polar faces, it assumes the equatorial position. This property has hitherto been found in the following substances, viz., platinum, palladium, iridium, titanium, an alloy of 0.825 of tin, 0.024 of bismuth, 0.108 of iron, in brass, German silver, wood-charcoal, coke (fossil coal belongs to the repulsive diamagnetic bodies), obsidian, native carbonate of iron, attractive glass, prussian blue, and solutions of iron.

In the majority of these substances the magnetic poles which they obtain during the influence of the electro-magnet disappear nearly as soon as this influence is removed; however, their existence is betrayed when the poles of the electro-magnet are suddenly changed, for then many of these bodies turn half round, as is the case with a magnetic needle; others do not exactly, but oscillate, thus indicating their tendency to a change of position. But we find some attractive diamagnetic bodies, such as a piece of iridium in my possession, wood-charcoal, and coke, which retain the poles they have acquired by the influence much longer, of which it is easily to be convinced by experiments on the mariner's compass. The experimental investigation of the phenomena exhibited by these bodies is complicated by this duration of the polarity; but they will probably lead us to discover the connection which exists between magnetism and diamagnetism.

When a needle constructed of an attractive diamagnetic substance is suspended above the upper or beneath the lower edge of a polar piece, it assumes a position parallel to this edge. In this parallel position, which might either be perpendicular to the magnetic axis of the polar piece, or parallel to it, or have quite another position than the figure of the polar piece requires, the disposition of the magnetic forces in the needle is transversal, as in a repellent diamagnetic body; but with this difference, that its lower part has the opposite magnetism to that of the polar piece, and the upper part that of the same nature.

I have not succeeded in causing iron to assume the diamagnetic state. An iron wire, of which the diameter is but $\frac{1}{10}$th of a millimetre, still takes the axial position just as well above the polar faces as between them, and with a force nearly sufficient to break the fibre of silk. This experiment has been varied by placing in a quill of a feather, which is repellent, a fragment of the same iron wire, merely 2 millimetres in length; but this arrangement still exhibited the same effects as the iron separately. The same result was also obtained on substituting for the bit of iron wire a very small particle of iron filings; but on introducing, in the place of iron, a piece of straw which had been immersed in a solution of iron, the diamagnetic effects of attractive bodies were obtained. Nickel gives the same results as iron. Thus nickel and iron ought properly to be called magnetic in the strict sense. This probably applies to some other substances, perhaps to cobalt.

There is consequently a decreasing magnetic progression which comprises the properly so-called magnetic substances, the attractive diamagnetic substances, and the repulsive diamagnetic substances. The magnetism of these last may be considered as negative, if the magnetism of iron and the attractive diamagnetic substances is regarded as positive.

The effect which the polar faces exert upon the attractive diamagnetic bodies is like that which takes place with the repulsive diamagnetic bodies—stronger when the body is placed nearer the upper or lower edges than their intermediate parts. A piece of attractive glass, 27 millimetres in length, which was suspended between the polar faces, 29 millimetres apart, in such a manner that the extremities of this needle were not more than 1 millimetre distant from the polar faces, was made to oscillate each time during 30 seconds. At an equal distance from the upper and lower edges it made only 4.5 oscillations in the 30 seconds, but level with the polar faces it made nineteen.

When the polar faces are at this distance the needle does not assume the equatorial position when it is suspended above their edges. At the distance of 4.5 millimetres it made 5.5 oscillations; 13.5 millimetres distant it made only 2.5 oscillations. The polar faces were approached to within 3 millimetres. The needle, which now could not assume the axial position between the faces, nevertheless showed its tendency to take that position; but raised 2 millimetres above their edges it assumed the equatorial position, and made 18 oscillaticns in 30 seconds. At a distance of $\frac{3}{10}$ths of a millimetre it made thirty-five oscillations. At the least possible distance, so as just to avoid contact with the polar pieces, it made forty-five oscillations.

It is seen that both the repulsive and the attractive diamagnetic bodies make more numerous oscillations in a parallel position to the polar faces than in the perpendicular position. It must, however, be observed, as has already been done, that the determinations of the numbers have not yet been carried sufficiently far to serve for the calculation of their laws.

I lately made some experiments on the influence which heat exercises on diamagnetic substances. These experiments are not yet numerous enough; they, however, prove to me that some attractive diamagnetic substances pass into the class of repulsive diamagnetic substances by an increased temperature. The only substance which exhibits this effect in a high degree is brass. My analogous experiments on other bodies are not yet sufficiently decisive to warrant their publication.

ON THE PRODUCTS OF THE SODA MANUFACTURE.

By JOHN BROWN, Esq.

[*Concluded from page* 192.]

IV. FORMATION AND ANALYSIS OF CARBONATE OF SODA.

The next stage of the process which comes under our consideration is the carbonate of soda process.

The carbonate of soda balls are lixiviated with water in the same way as in the manufacture of soda-ash. The liquor from the settler is pumped up into a pan, where it is evaporated till it becomes nearly dry; it is then taken out of the pan in colanders, thrown up in a heap, and allowed to drain. The sulphuret of sodium and caustic soda soon deliquesce and drain out from the salt.

The salt, after drying at 212°, gave, when analyzed:—

	I.	II.
Carbonate of soda ..	79.641	80.918
Hydrate of soda	2.712	3.924
Sulphate of soda. ...	8.641	7.431
Sulphite of soda	1.238	1.110
Sulphuret of sodium	trace	0.230
Hyposulphite of soda	trace	trace
Chloride of sodium..	4.128	3.142
Aluminate of soda ..	1.176	1.014
Silicate of soda	1.234	1.317
Insoluble matter	0.972	0.768
	99.742	99.854

This salt is then introduced into a reverberatory furnace and carbonated. The last traces of sulphur are thus oxidized, and almost the whole of the hydrate is converted into carbonate.

This salt yielded on analysis:—

	I.	II.
Carbonate of soda ...	84.002	83.761
Hydrate of soda	1.060	0.734
Sulphate of soda	8.560	9.495
Sulphite of soda	trace	0.386
Chloride of sodium..	3.222	3.287
Aluminate of soda ...	1.013	0.620
Silicate of soda	0.984	0.780
Insoluble matter	0.716	0.846
	99.557	99.909

A finer kind of soda-ash is frequently made from this salt by dissolving it in water, evaporating to dryness, and carbonating. It contains very little caustic soda, and should average about 50 per cent. of alkali.

It yielded on analysis:—

	I.	II.
Carbonate of soda ...	84.314	84.721
Hydrate of soda	trace	0.280
Sulphate of soda	10.260	9.764
Sulphite of soda	trace	
Chloride of sodium..	3.480	3.140
Aluminate of soda ..	0.632	0.716
Silicate of soda	0.414	0.318
Insoluble matter	0.250	0.498
	99.350	99.437

It is from this salt that the crystallized carbonate of soda is manufactured. The ash is dissolved in boiling water until the solution attains a specific gravity of 1.250 (50° Twaddell); it is then run into a cistern, where it is mixed with sufficient cold water to reduce the specific gravity to 1.21 (42° Twaddell). This occasions the deposition of a quantity of earthy matter. A little bleaching-powder is then added to the liquid, which causes another deposition. After this has been allowed to settle, the solution is carefully decanted into another pan, and evaporated till it attains a specific gravity of 1.27 (54° Twaddell). From this it is run into another cistern, from which it passes into the crystallizing pans. The average time taken in crystallization is eight days; but it of course varies very much with the season of the year and the state of the atmosphere. It is greatly assisted by placing a few bars of wood, two or three inches broad, on the top of the liquor.

The crystallized carbonate of soda thus obtained yielded on analysis:—

	I.	II.
Carbonate of soda ...	36.476	36.931
Sulphate of soda	0.943	0.542
Chloride of sodium ..	0.424	0.314
Water	62.157	62.213
	100.000	100.000

As it contains ten atoms of water of crystallization, its formula is $NaO, CO_2 + 10HO$, and the per-centage composition calculated from this formula is:—

Carbonate of soda	37.500
Water	62.500
	100.000

By driving off the water from these crystals by heat, a very pure carbonate of soda is obtained, which is used in the manufacture of glass.

It yielded on analysis:—

Carbonate of soda ...	98.120	97.984
Sulphate of soda	1.076	1.124
Chloride of sodium..	0.742	0.563
	99.938	99.671

THE CHEMICAL TIMES.

SATURDAY, FEBRUARY 17, 1849.

THE TOOTING CHOLERA CASES.

Several of our correspondents find great fault with us for our remarks on the Tooting cholera cases. We are accused of having taken a most prejudiced view of the subject, and of having blindly subscribed to the extravagant opinions of Mr. Wakley and of the two juries who deemed it their duty to return a verdict of manslaughter against Mr. Drouet. One of our correspondents deprecates what he calls our "attacks upon the character of Mr. Drouet," and our endeavour to excite a prejudice against an individual lying under a grievous imputation and awaiting a serious trial. He asks us, "Whether any reasonable man can even for one moment entertain the notion that the verdicts returned against Mr. Drouet have a shadow of a valid foundation to rest upon?" and expresses his firm conviction "that the matter will be at once contemptuously disposed of by the judge the moment it shall be brought before the court."

Now, we must confess we cannot, for the life of us, see that Mr. Drouet has suffered any hardship or injustice at the hands of the conscientious men who, after a most patient and most calmly and impartially conducted inquiry, deemed it their duty to refer to another tribunal the question, whether from 150 to 200 children have been swept away simply by a malignant disease of an entirely accidental character, and against the advent of which all human foresight and precautions would have proved unavailing, or whether the death of these children ought not rather to be imputed to the effects of a systematic course of insufficient and bad diet and clothing, aided by want of proper nursing in the hours of illness, and by the mental depression so necessarily produced in children by an habitually cold and harsh treatment. We are quite aware that our correspondent may be perfectly right in his opinion regarding the manner in which the judge will deal with the accusation of manslaughter against Mr. Drouet. We know full well that, in a legal point of view, it would not be a very easy task to fix that accusation upon Mr. Drouet, and that that gentleman will probably escape unscathed. But all this does not alter the question one iota in a *moral* point of view. We are not desirous of exciting any undue prejudice in the public mind against Mr. Drouet; nor should we have reverted to the subject now were it not that we have perceived of late a strong desire on the part of that gentleman and of his friends, and on the part of some boards of guardians (?) of the poor, to represent the treatment of pauper children (Heaven help them!) at Surrey-hall as everything that could be desired by the most humane, and to depict the conduct of Mr. Wakley and of the two juries who returned verdicts of manslaughter against the proprietor of that establishment as unjust in the extreme. We begin to see very clearly that a bold stand will be made by the poor-law boards to maintain the iniquitous system of farming children, and that in a very short period of time Surrey-hall will, probably, be as crowded, and its inmates be as starved and unhappy, as they were before the late outbreak of the cholera in that establishment.

We had written thus far when we heard of the reported death of Mr. Drouet. This event cannot alter the spirit of our remarks. We never dealt with this matter as a question of persons: to us it is simply a question of principles.

That an attempt will be made to turn the death of Mr. Drouet (*if* that event have *really* taken place) to good account, for the purpose of raising a storm of indignation against the coroner, the jury, and the public journals, who have *conscientiously* done *their duty* in the Tooting affair, is a matter which admits of very little doubt. Mr. Eaton, the master of St. Pancras workhouse, who reported the death of Mr. Drouet to a meeting of the vestry of St. Pancras, stated that the deceased had declared himself to be a "murdered man;" and Mr. Francis

Healey, the churchwarden, stated that "Mr. Drouet had for some years been subject to an affection of the heart, and the excitement produced by the late lamentable occurrence in his establishment, and the severe verdicts of the coroners' juries, and attacks of the public press upon him, had so increased the disease as to render the unfortunate man's life in imminent danger." There was a great deal of sympathy expressed for the unhappy fate of Mr. Drouet. With this we are far from quarrelling. But we would wish these "gentlemen of the vestry" to have some sympathy to spare also for the deplorable fate of the unhappy children who have fallen victims to the "Tooting system."

We should not wonder to see the coroner for the county of Surrey, who did not deem it worth while to hold an inquest upon the 150 children who died at Surrey-hall, summon a jury *now* to inquire into the death of the master of that establishment; nor would it surprise us much to hear the death of that gentleman imputed, though not, perhaps, in an express verdict to that effect, to Mr. Wakley, his two juries, and the public papers.

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON FEB. 14, 1849:—				
In London and vicinity, viz.:—				
Whitechapel	3			
West India Docks	1	1		
Bethnal-green	2			
Southwark	1	1		
In the country, viz.:—				
East Reedham	25	3		
In Scotland, viz.:—				
Edinburgh	3	3		
Glasgow	19	8	23	
Loudon	1	1		
Riccarton	4	1	5	
Galston	3	1	6	
Stirling	19	9		
Greenock	2	..	1	
Newton, Dalkeith	2	2		
Stow	5	1		
Hamilton	6	5		
Tillicoultry	16	4		
Eaglesham	3	3		
Total new cases	115	43	35	
In London and vicinity	1020	541	135	344
In the country	884	386	144	354
In Scotland	9937	4330	3136	2471
Total	11841	5257	3415	3169

BIRTHS AND DEATHS IN LONDON DURING THE WEEK ENDING SATURDAY LAST.

The number of deaths in the metropolis (according to the list published by authority of the Registrar-General) from all causes, during the week ending on the 10th of February instant, amounts to 1,196, being 27 above the average of 1844 and the four following years, and 59 above the number of deaths in the previous week. This increase is attributed to inflammation of the lungs and bronchitis, especially the latter; diarrhœa and dysentery number 37, which is considerably more than occurred in any of the first six weeks of five previous years, while the deaths from diarrhœa, dysentery, and cholera together are equal to six times the weekly average. The deaths from zymotic diseases are 345; from disease of the lungs and organs of respiration, 234; scarlatina, 55; hooping cough, 58; cholera, 55; typhus, 71; consumption, 113; convulsions, 48; pneumonia, 103. The births registered during the week ending the 10th of February instant are 1,673, 846 males, 827 females, being an increase of 504 over the weekly average of the year 1844 and the four following years.

The following fatal cases of cholera were registered in the week ending Saturday, Feb. 10, 1849; five are cases in which inquests were held, the remainder are all certified by medical attendants:—

KENSINGTON; Town.—At Jenning's-buildings, son of a labourer, 12, "cholera (2 days); typhoid fever (3 days)." At same buildings, hawker, 42, "cholera (24 hours);" at the workhouse, wife of a labourer, 45, removed from Jenning's-buildings, "cholera (48 hours); typhoid fever (4 days)."

WESTMINSTER; St. John.—In Millbank Prison, M. 60, "Asiatic cholera (about 18 hours); diarrhœa (1 day previous)," p.m. Inquest. In same prison, F. 26, "Asiatic cholera (about 3 days); occasional attacks of diarrhœa for about 19 days previous," p.m. Inquest. St. Margaret.—In the workhouse, M. 54, "diarrhœa (2 days); cholera (12 hours)."

ST. PANCRAS; Tottenham-court.—In University College Hospital, a soldier, 49, "malignant cholera (7 days);"—p.m. Mr. Wells, the registrar, states that "he was a native of Limerick, and traded from that place to Liverpool, where he was seized with vomiting on Monday, the 29th ult. He came to London on the same night, took lodgings near the Euston station, was seized with cramp on Tuesday, and admitted into the hospital on Thursday. The cold stage of the disease did not commence until Thursday night. He had been a teetotaller, but broke the pledge and was drunk two days before the attack."

HACKNEY; Hackney.—M. 55, "cholera (56 hours);" M. 38, "Asiatic cholera (50 hours), consecutive fever (4 days);" M. 35, "cholera (24 hours);" F. 72, "spasmodic cholera (13 hours), diarrhœa, collapse (same day);" F. 52, "spasmodic cholera, diarrhœa, cramp (14 hours), collapse;" F. 71, "spasmodic cholera, diarrhœa, cramp, collapse;" F. 82, "cholera, diarrhœa, collapse;" F. 77, "cholera (17 hours). The four following cases are those of children belonging to the Islington poorhouse, lately removed from Surrey-hall, Tooting, to Park-house, Church-street, Hackney:—M. 3, "Asiatic cholera (18 hours); debility (13 hours);" M. 14, "Asiatic cholera (10 hours);" M. 7, "Asiatic cholera (10 hours);" M. 7, "Asiatic cholera (17 hours)." South.—M. 34, "malignant cholera (30 hours);" F. 37, "Asiatic cholera (2 days)." Mr. Drewett, the registrar, states that "this woman died in a locality of the worst possible condition as regards drainage, most of the inhabitants having no other means of getting rid of refuse in a liquid state than by casting it into the street. The whole of the street is a continued pool of filth. Another case of the same character two doors from the above, but the patient has nearly recovered.

HOLBORN; St. Andrew, Eastern.—At the Union-house, F. 12, "Asiatic cholera."

CLERKENWELL, St. James.—In Middlesex House of Detention, F. 25, "malignant cholera, produced by causes occurring out of the prison in a person of debilitated condition." Inquest. Mr. Western, the registrar, states that "this person had come from a house of bad character in Whitechapel, and had been remanded at the Worship-street Police Court on a charge of robbery. She was brought in the prison-van about half-past seven o'clock on the 9th instant, had a warm bath, and was taken to her cell about half-past eleven o'clock. The medical man promptly attended, but she sunk at ten minutes before five on the morning of the 10th. It appeared that she had suffered from a very bad leg almost in a state of mortification."

SHOREDITCH; Haggerstone, East.—M. 52, "Asiatic cholera (21 hours);" M. 58, "Asiatic cholera (34 hours);" F. 47, "Asiatic cholera (28 hours)." Mr. Ditchman, the registrar, states that "the first and second, together with a case of fever, occurred in ill-drained parts, where there are no sewers. The third occurred in Ann's-place, in a house adjoining that from which two deaths were returned on the 2d of December. The house stands on the very edge of the open sewer, which has been so often complained of by the parochial authorities and others to the commissioners of sewers. Still it remains in the same filthy state."

BETHNAL-GREEN; The Green.—M. 37, "cholera (21 hours);" F. 46, "cholera (12 hours)." Church.—F. 27, "Asiatic cholera (22 hours)." Town.—At 11, Little Manchester-street, M. 29, "15½ hours." Hackney-road.—Hawker of green-grocery, 31, "cholera morbus (3½ days)." This man came in from his occupation on Saturday evening, having stood in the cold for some hours, had a hearty meal, and was taken ill immediately afterwards. Daughter of the above, 2, "cholera morbus (24 hours)." She had, like her father, been accustomed to uncertain diet. Son of a plasterer, 5, "cholera morbus (2½ days)." His father had been out of employment for eleven weeks, was in poverty, and lived in a crowded, ill-drained, and dirty neighbourhood. In Hackney-road, house-painter, 67, "diarrhœa (14 days), cholera (33 hours)." Son of a carpenter, 3, "English cholera (60 hours)." He lived in a low, poor, and crowded neighbourhood. In Castle-court, Old Castle-street, a blind woman, the wife of a mendicant, 77, "sudden death from malignant cholera."—Inquest. She lived in abject poverty, and in the court is a dust-heap, composed of offensive matter. The water is supplied to all the houses by a tap on the main, the drainage from which is defective, and leaves a pool of stagnant water to emit exhalations. Son of a working man, 2, "natural death, sudden from cholera."—Inquest. He was one of a family of seven persons who lived together in a small room, where (it appeared at the inquest) the children fared very hardly. Another child in the family has died of the same disease. Mr. Murray, the registrar, also reports the death of a woman, 58 years, from "diarrhœa after 5 days' illness." She was the widow of a toymaker, who died in the same house from cholera a fortnight ago. He adds, that the poor generally are not acquainted with what has been published regarding the premonitory symptoms of cholera.

WHITECHAPEL; Spitalfields.—M. 6, "Asiatic cholera (20 hours);" M. 9, "Asiatic cholera, without premonitory symptoms (16 hours)." Goodman's-fields.—At 40, Great Prescot-street, a lady, 68, "Asiatic cholera (18 hours)."

STEPNEY; Shadwell and Wapping.—M. 1, "malignant cholera (4 days)."

ST. SAVIOUR; St. Saviour.—M. 5, "Asiatic cholera (13½ hours);" M. 43, "diarrhœa (12 hours), Asiatic cholera (30 hours);" M. 20, "Asiatic cholera (22 hours);" F. 24, "Asiatic cholera (50 hours), consecutive fever, ending in convulsions and coma."

BERMONDSEY; St. Mary Magdalen.—At 21, Mellick's-place, Russell-street, F. 42, "diarrhœa (3 days), cholera maligna (32 hours)."

ST. GEORGE, SOUTHWARK; Kent-road.—At 5, Mint-street, a labourer, 48, "cholera maligna (3 days)."

LAMBETH; Waterloo-road, First Part.—At Whitehorse-street, daughter of a tinman, who vends goods in the streets, 8, "cholera Asiatica (20 hours), exhaustion and coma." Mr. Mears, the registrar, states that "the locality where the above case occurred abounds in dirt, and is crowded by persons of dissolute habits."

Greenwich; West.—In Dreadnought hospital-ship, M. 26, "dysentery (4 months), cholera (9 hours)," p.m. In same hospital, M. 21, "cholera (2 days)," p.m.

Wandsworth; Wandsworth.—M. 9, "cholera (3 days);" M. 70, "cholera (36 hours);" F. 69, "Asiatic cholera (12 hours), exhaustion (13 hours)." Battersea.—At union workhouse, son of a milkman, 7, "malignant cholera (4 days), consecutive fever with gastritis (21 days)." At Church-street, wife of a stable-keeper, 56, "malignant cholera (15 hours)." In the sub-district of Streatham and Tooting Graveney, and at Mr. Drouet's establishment, a boy, aged 4, died of "fever and mortification" after an illness of three weeks.

COALS IN THE NEW WORLD.

The following is a report from the Museum of Practical Geology on specimens of coal from Sandy Bay, Talcahuano Bay, near Conception, Chili, and from Vancouver's Island, brought to England in her Majesty's steam-frigate Sampson, Captain Henderson, C.B., recently paid off from the Pacific:—

"Museum of Practical Geology,
Jan. 30, 1849.

"Sir,—With reference to the fossil fuel from Sandy Bay, Patagonia, Talcahuano Bay, and Colcurra Bay, Chili, and from Vancouver's Island, forwarded to the Museum of Practical Geology from the Admiralty for examination, and brought home by her Majesty's steamer Sampson, I have the honour herewith to forward a statement of analysis conducted under the superintendence of Dr. Lyon Playfair, from which it results that the two specimens from Sandy Bay come under the head of that variety of fossil fuels called brown coal or lignite. They are, however, good varieties of that fuel, although containing a large quantity of ash. Lignites, though not so good as real coal for steam purposes, may yet be often advantageously employed when the latter is not to be procured.

"The locality of this lignite would appear to render it particularly worthy of attention, more especially as to its abundance and easy access.

"The specimens from Talcahuano Bay and Colcurra Bay, Chili, are real coals, and, so far as can be inferred from the portions sent, would appear to be of that variety known as cannel or candle coal. That from Talcahuano Bay is a very fair average coal; that from Colcurra Bay is equal, in evaporative value, to good Newcastle coal, judging, at least, from the analysis.

"The specimen from Vancouver's Island is also one of a true coal, of the kind found at Newcastle. It, however, contains much earthy matter. The specimen may be from the cap, or portions exposed to the weather, and, indeed, may be but from one of the several beds supposed to exist in Vancouver's Island, which may not give a fair estimate of the quality of its coals generally.

"The lignites and coals, of which specimens were sent, may all be made applicable to steam navigation, especially the coals, if they can be obtained in sufficient quantity and with the requisite facility.

"I have the honour to be, sir,
"Your very obedient servant,
"H. T. De la Beche.
"Captain Hamilton, R.N."

"Museum of Practical Geology,
Jan. 30, 1849.

"Sir,—I have now the honour to state the results of my examination of the coals sent to this museum for analysis, and described as 'Specimens of coal from Sandy Bay, Straits of Magellan, and Chili, brought by her Majesty's ship Sampson.'

"Specimem I.—Coal from Sandy Bay, Patagonia.

"This coal is brown, having the appearance of a lignite; it does not soil the fingers. It is easily broken in any direction, and the interior presents a black mass interspersed at intervals with light brown specks, which are due to some resinous matter. In some parts a yellow resin, probably amber, is found.

Carbon	62.25
Hydrogen	5.05
Sulphur	1.13
Nitrogen	0.63
Ash	13.40
Oxygen	17.54
	100.00

"This coal burns without swelling, gives a little flame, and a very pungent smoke, ash grey.

Specimen II.—Sandy Bay.

"Is perfectly identical in appearance with the former specimen, and presents the same phenomena on ignition.

Carbon	59.63
Hydrogen	5.68
Sulphur	0.96
Nitrogen	0.64
Ash	15.64
Oxygen	17.45
	100.00

"Coal from Talcahuano Bay, near Conception, Chili.

"This coal does not soil the fingers, is very hard—has something of a conchoidal fracture. The interior is perfectly and uniformly black, while almost the entire exterior surface is covered with a grey film, as if the coal had decayed under the influence of the atmosphere. It burns without swelling, giving considerable smoke and flame, and yields a greyish ash.

Carbon	70.71
Hydrogen	6.44
Sulphur	0.90
Nitrogen	1.08
Ash	6.92
Oxygen	13.95
	100.00

"Coal from Vancouver's Island.

"Resembles much in appearance Newcastle coals, has a black glossy surface, it breaks easily; earthy matter is found running in lines through it. It burns with a considerable amount of smoke and flame, and leaves a grey ash.

Carbon	66.93
Hydrogen	5.32
Sulphur	2.20
Nitrogen	1.02
Ash	15.82
Oxygen	8.71
	100.00

"Coal from Colcurra Bay, near Conception, Chili.

"Very closely resembles the coal from Talcahuano Bay, but there is an appearance of decomposition even in the interior. It burns with considerable smoke and flame, leaving a reddish-yellow ash.

Carbon	78.305
Hydrogen	5.506
Sulphur	1.060
Nitrogen	1.090
Ash	5.670
Oxygen	8.369
	100.000

"You will remark that the specimens from Sandy Bay are not coals, but lignites; that the coals from Chili resemble the cannel coal of this country, so far as may be judged from the small specimens sent; and that the coal from Vancouver's Island resembles ordinary Newcastle coal, except that it contains much more earthy matter than good coal from the Newcastle field.

"I have the honour to be, sir,
"Your faithful and obedient servant,
"Lyon Playfair.
"Sir Henry T. De la Beche, F.R.S., L.S."

Picrotoxia.—Picrotoxia or picrotoxic acid is a bitter, crystallizable, and poisonous substance, discovered by Boullay in Cocculus indicus. It is soluble in boiling water, alcohol, ether, and acetic acid.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Charles Hancock, of Brompton, in the county of Middlesex, gentleman, for improvements in apparatus or machinery for giving shape and configuration to plastic substances. Patent dated July 29th, 1848. Enrolled January 29th, 1849.

Various modes of treating plastic substances for their formation into articles and wares are described in this specification; the improvements being in the apparatus to be employed in manufacturing certain articles. The specification is divided into several parts, and consists—First, of apparatus for manufacturing hollow ware from plastic materials, by moulding or shaping them upon cores or moulds. The apparatus employed by the patentee for this purpose comprise a bed or frame, mounted with a head and mandril, in all respects similar to those parts of a lathe. Upon the end or nose of the mandril is screwed the core or mould, upon which the plastic materials are to be formed into the shape required. The mould is made very nearly similar to the blocks used by hatmakers, being composed of a square central piece, and four segmental pieces around it, the outer surfaces of these segmental pieces forming the moulding surfaces. The central square piece is screwed upon the nose of the mandril by one end; upon each side of this square piece is a projecting dovetailed piece, running the whole length, and parallel with the face. Upon each of the segmental pieces are corresponding grooves, into which the dovetailed pieces enter when the segmental pieces are placed upon the central piece, thereby securely holding them together, and presenting the form required for the interior of the vessel or article to be formed, over which the plastic material is placed, rotary motion being given to the mandril, and likewise to the mould or core, by means of a pulley fixed upon the mandril. When other shaped articles or wares are required to be formed, all that is necessary is to remove the segmental pieces only, leaving the central piece still attached to the mandril, and to substitute for them other segments whose outward surfaces shall be those required. There is no necessity to remove the central piece, as that is made to suit many sets of segments; therefore, the different forms and moulds may be changed with facility. The plastic materials being shaped upon the moulds are allowed to remain until sufficiently hard, and in a state fit to be removed, when the withdrawing of the segmental pieces with the shaped article upon them from the central piece allows the segmental pieces to be removed singly from the interior of the article; the mandril is driven by means of any convenient first mover.

Secondly. Of apparatus for moulding and forming hollow articles and wares different from the foregoing. The patentee describes modifications of this apparatus adapted for the moulding and forming of articles from materials which require to be heated while being formed, as well as those not requiring such heat. The first of these apparatus described consists of a mandril mounted in a head, as in the former case, but now it is placed in a vertical position, and the mandril is hollow; the upper end or nose of the mandril has screwed to it a circular-shaped hollow vessel or chuck, being nearly three fourths of a globe. Within this chuck is placed a second vessel, of less capacity than the first, the edges of the two coming together, and forming a steam-tight joint, leaving a space between the two vessels, into which hot or cold water, or steam, as occasion may require, is passed through the hollow mandril. The second vessel forms the mould, into which the plastic materials are placed; above this apparatus, and placed concentrically with the mandril, is a vertical rod, capable of moving vertically in guides; to the upper end of this rod is a weighted lever, for

the purpose of giving pressure to the rod, and also for lifting it when necessary; to the lower end of the rod is attached, by a key or screw, a block or mould, which forms the mould or core for shaping the materials—the shape and configuration of this agreeing with the mould upon the chuck upon the mandril. Motion is given to the mandril, and, consequently, to the mould attached to it, by any first mover, a pulley being upon the mandril for that purpose. The mode of proceeding is thus:—A quantity of the plastic material being thrown into the concave mould upon the end of the mandril, the upper mould upon the end of the vertical rod is now let down upon the material, and rotary motion given to the mandril; and if the plastic material is of such a nature as to require heat to facilitate the moulding, then steam or hot water is to be passed into the space between the lower mould and the chuck, through the hollow mandril. By this means the plastic material will fill the whole space between the two moulds, and the surplus, if any, will be delivered over the edges of the moulds, to be afterwards cut off. When the article is formed, then the hot water or steam is to be let off from between the moulds, and cold water may, if required, be let in to facilitate the cooling, when the article can be removed; or both the moulds may be removed with the article still on it, although not sufficiently cold to be removed from the mould, and another mould substituted on to the chuck, and the process repeated. Another arrangement of apparatus for the same purpose consists in giving the rotary motion to the vertical rod and upper mould while the lower mould is stationary, the mandril being in this case dispensed with. Hot water or steam is passed into the space around the lower mould, as before described. In another modification the rotary motion is given to the lower mould, though without any provision for the introduction of hot water or steam. This arrangement is intended for the moulding of plastic materials which do not require the application of heat to them to render their being shaped with greater facility.

Thirdly. In apparatus for pressing and squeezing plastic substances, preparatory to their being shaped and formed by moulds, as also for other purposes. The machinery consists of two side frames, upon which are mounted a number of friction rollers, carrying a table or platform which can be moved longitudinally upon the rollers by a rack and pinion, or other suitable means. This table is made hollow, and filled with hot water or steam. Above the middle of the framework is a plate or presser, which is to be actuated up or down by a steam cylinder and piston, or by a screw or any other suitable means. The mode of operation is thus:—A quantity of the plastic material to be pressed and kneaded is thrown upon the table, hot water and steam being admitted for the purpose of warming it and the plastic material. The presser is now forced down, by which the material will be pressed or squeezed. The table is now moved along upon the rollers, thereby drawing the plastic material in a thin sheet from under the presser; this is gathered up in a heap at the end of the table, and is again submitted to the operation until in a fit state for the moulding apparatus.

Fourthly. In machinery for forming from plastic materials pipes, and such like articles, of considerable length, which require cores for the purpose of supporting them. This consists of a pressing cylinder, into which the plastic material is placed and pressed down by a piston, or plunger. At the bottom of the cylinder a die-box is placed, into which the materials are pressed. A number of holes are made through the die-box, on both sides; apertures being made from the body of the die-box to these holes, through which the materials are pressed into the holes. Upon one side of the machine a number of reels are placed, around which are wound the wires or cords to form the cores of the pipes; these wires or cords pass through the holes in the die-box, and are then passed on to the other side of the machine, where they are again wound upon other reels. The mode of operation is first to cause a continuous pressure to be exerted by the piston in the cylinder upon the plastic materials therein; at the same time the wire or cord cores are drawn through the die-box, by which means they are covered with a layer of the plastic material, the exterior diameter being equal to the diameter of the holes. They are wound, with the plastic material upon them, upon the reels, care being taken that they are sufficiently cooled before being wound, either by having the reels at a sufficient distance from the die-box, or by passing them through cold water. The cores are afterwards removed. The material cylinder is surrounded by a case containing hot water or steam, for the purpose of heating the plastic materials within. The patentee describes a modification of this apparatus, by which pipes, or articles having several holes or passages through them, are formed, such holes being parallel, or nearly so, to each other, by the employment of several wires or cords, as cores to one aperture in the die-box; the direction of these apertures in the die-box are at right angles, or nearly so, to the direction of the piston in the cylinder.

Fifthly. In the modification of the last-named apparatus, by which shorter lengths of the material are formed, suitable for cornices, mouldings, and other similar purposes. The apparatus for pressing is the same as before; the die-box is, however, suited to the shape or form required, a supporting core of wood, metal, or other rigid substance, being passed through the die-box, having each end fixed to a standard or prop, supported upon a traversing table or frame; by this means the core is passed through the die-box, and thus the article desired is formed; although while upon the cores the articles produced are quite straight, yet they may be afterwards bent to almost any curvature required.

Sixthly. In machinery for forming plastic material into solid balls. This consists simply of a pair of rollers, upon the surfaces of which are semi-globular recesses, the relative positions of which are such that, as the rollers revolve in close contact, the recesses of one exactly coincide with those upon the other. These rollers, when revolving, are fed from a mass of the plastic material placed immediately in front of them.

The patentee claims:—

First. The apparatus described for forming and moulding hollow wares, so far as regards the chuck and shifting moulds.

Secondly. The apparatus for forming and moulding hollow ware, operating either with or without those parts for the purpose of heating or cooling, as described.

Thirdly. The apparatus described; being a combination of a vertical presser with a hollow horizontal bed or table filled with hot water or steam, whether fixed or movable, for the purpose of preparing plastic materials.

Fourthly. The apparatus described for forming and moulding plastic materials into continuous lengths, by means of supporting cores of wire, cord, or other similar material, so far as regards their combination with a die-box, and cylinder and piston, working or operating at right angles, or at other angles with each other.

Fifthly. The modification of the last-described apparatus, for forming and moulding shorter lengths of plastic material.

Sixthly. The apparatus for forming and moulding balls of materials other than metals, as described.

George Walter Pratt, of the city of Rochester, State of New York, in the United States of America, gentleman, for improvements in the manufacture of printing ink. Patent dated July 29th, 1848. Enrolled September 29th, 1848.

This specification describes a mode of making printing ink, by the use of resin oil, as a substitute for linseed oil, or other oils hitherto used, such oils being dearer than the resin oil proposed to be used. He gives the following process for a printing ink of ordinary consistence:—Take one ounce of resin oil (an article of commerce procured by the distillation of resin), thirteen ounces of resin, and five ounces of yellow soap; heat, and intimately mix them by stirring. When cold, this composition or varnish may be ground up, as usual, with the pigments to be added for giving the required colour to the ink. The patentee does not confine himself to the precise detail herein given; but claims the use of resin oil in printing inks, as a cheap substitute for linseed oil, or other oils hitherto used.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING FEBRUARY 8, 1849.

Jeanne Adolphe Cartéron, of Paris, in the Republic of France, now of the Haymarket, in the county of Middlesex, chemist, for certain improvements in dyeing. Patent dated February 5th, 1849; six months.

John Browne, late of Bond-street, but now of Great Portland-street, Middlesex, gentleman, for improvements in constructing and rigging vessels; and improvements in atmospheric and other railways. Patent dated February 6th, 1849; six months.

Edmund George Pinchbeck, of Fleet-street, in the city of London, for improvements in certain parts of steam-engines. Patent dated February 6th, 1849; six months.

Thomas Snowdon, of Noel-street, in the county of Middlesex, engineer, for improvements in machinery for moulding and pressing artificial fuel and bricks. Patent dated February 6th, 1849; six months.

Joseph Harrison, of Blackburn, in the county of Lancaster, machine-maker, and William Harrison, of Blackburn, in the same county, cotton-manufacturer, and John Oddie, of Blackburn, assistant manager, for certain improvements in and applicable to looms for weaving. Patent dated February 6th, 1849; six months.

Henry Fisher, of Upholland, in the county of Lancaster, gentleman, for improvements in coke-ovens, and in machinery and apparatus for working the same, or connected therewith; and a mode or modes of applying certain portions of coke, or the residual products of coke, to heating and lighting. Patent dated February 8th, 1849; six months.

Lawrence Hill, junior, of Motherwell Iron Works, near Hamilton, Lanarkshire, civil engineer, for improvements in the manufacture of iron, and in the machinery for producing the same. Patent dated February 8th, 1849; six months.

Henry Headley Parish, of Eaton-place, in the county of Middlesex, Esq., for improvements in safety and other lamps, and in gas-burners. Patent dated February 8th, 1849; six months.

Richard Pannell Forlong, of Bristol, button-manufacturer, for improvements in castors for furniture. Patent dated February 8th, 1849; six months.

William Willcocks Sleigh, of Stamford-brook-house, Chiswick, in the county of Middlesex, doctor of medicine, for a means of preventing injuries to persons and property from the sudden stoppage of railway carriages. Patent dated February 8th, 1849; six months.

James Webster, of Basford, in the county of Nottingham, engineer, for certain improvements in apparatus for manufacturing gas. Patent dated February 8th, 1849; six months.

John Taylor, of Parliament-street, Westminster, architect, for an improved mode of constructing and fencing walls. Patent dated February 8th, 1849; six months.

Joseph Barnes, of Church, in the county of Lancaster, for an improved apparatus for bleaching, dyeing, cleaning, and steaming animal or vegetable fibrous substances, either in a raw or manufactured state. Patent dated February 8th, 1849; six months.

Robert Brown, of Sadler's-wells, in the county of Middlesex, engineer, for improvements in machinery for perforating, sewing, stitching,

pegging, and riveting. Patent dated February 8th, 1849; six months.

William Tooth, of Broad-street, Lambeth, engineer, for improvements in water-closets and in chimneypieces, in machinery for the preparation of clays and other materials, and in the manufacture of earthenware articles. Patent dated February 8th, 1849; six months.

Thomas Charles Clarkson, of Bennett-street, Southwark, manufacturer, for certain improvements in the manufacture and application of leather, and certain vegetable substances, to be used, in combination with leather, indiarubber, canvas, silk, cotton, wool, and other fibrous substances, in the manufacture of certain waterproof articles. Patent dated February 8th, 1849; six months.

PATENTS RECENTLY EXPIRED.

T. Roberts, of the dockyard, Plymouth, for an improved mode of joining pieces of timber together, end to end, which improved mode is applicable to the purposes of making the masts and topmasts of ships; also for making piles, and for certain other purposes wherein timber is required to be lengthened, whereby an immense saving will accrue, inasmuch as masts can be lengthened or made from common fir timber, topmasts from shorter and less expensive sticks, and piles made to any required length. Patents dated February 6th, 1835; expired February 6th, 1849.

C. Cleveland, of London, clerk, for certain improvements in pens, penholders, and apparatus for the supplying ink to pens, and an apparatus for the making of pens. Patent dated February 9th, 1835; expired February 9th, 1849. (Communication.)

J. Halstead, of Middlesex, sailmaker, for a new and improved paddle-wheel for steam-vessels, which wheel is also applicable to mill machinery of every description moved by water. Patent dated February 9th, 1835; expired February 9th, 1849.

J. Leeming, of Manchester, worsted-spinner, for certain improvements in the construction of water-wheels and of paddle-wheels. Patent dated February 9th, 1835; expired February 9th, 1849.

THE LATE OUTBREAK OF CHOLERA AT TOOTING.—REPORTED DEATH OF MR. DROUET.

On Wednesday, at a very numerously-attended meeting of the St. Pancras vestry, held at the new Vestry-rooms, King's-road, Camden-town,

Mr. Francis Healey, churchwarden, in the chair,

Mr. Clarke said he wished to put a question to the chairman. Since he had been in that room he had been informed that Mr. Drouet, the proprietor of the Infant Pauper Asylum at Tooting, was dead, and he wished to know if there was any official communication on the subject. The statement which he (Mr. Clarke) had heard was that Mr. Eaton, the master of St. Pancras workhouse, had received a letter from Tooting, stating that Mr. Drouet had died last night, and that before he died he had declared himself to be a "murdered man," the charges made against him, as to his treatment of the children at the inquests held by Mr. Wakley, the coroner, being wholly without foundation. He wished to know if the chairman was in possession of information on the subject.

The Chairman said he had no doubt from what he had heard from Mr. Howell, a vestryman, that such a deplorable event had taken place. He had understood that Mr. Drouet had for some years been subject to an affection of the heart, and the excitement produced by the late lamentable occurrence in his establishment, and the severe verdicts of the coroners' juries and attacks of the public press upon him, had so increased the disease as to render the unfortunate man's life in imminent danger. Indeed, he understood that the night before last it was found necessary to call in the aid of Dr. Chambers and two or three other eminent physicians, and that not the slightest hope was then entertained of his recovery. He (the chairman) had been told by his friend Mr. Howell that the master of the workhouse had received a communication announcing Mr. Drouet's death, and he had no doubt it was too true, from the information he had previously received.

Mr. Morris said the fact was the poor man lost his wife but a few months back, and that tended greatly to destroy the order and regularity which had previously prevailed in his establishment, and that circumstance had in all probability produced the awful visitation which every one must deplore. The coroner's inquests coming on this had killed Mr. Drouet.

On the motion of Mr. Hatton, Mr. Eaton, the master of the workhouse, was called before the vestry, and, in answer to questions, said he had not received the communication officially from Tooting, but from a friend of Mr. Drouet's, on whom the greatest reliance could be placed. He stated that Mr. Drouet had died on the previous night, and that whilst dying he made use of the observations alluded to by Mr. Clarke. He (Mr. Eaton) from his previous knowledge of Mr. Drouet's state had no doubt of the fact.

The chairman and several members of the vestry expressed their regret at the circumstance, and the vestry, after some other business, separated.

THE ELECTRIC LIGHT.—THE RIVAL CLAIMS OF MR. STAITE AND M. FOUCAULT.—At a recent sitting of the Paris Academy of Sciences, M. Dumas presented the report of the commission appointed at the previous sitting to examine the apparatus devised by M. Foucault for producing a continuous electric light. The commission are perfectly satisfied that M. Foucault made the discovery a long time since, and, whilst they cannot contest with Mr. Staite the priority of the invention, they award to M. Foucault the merit of having realized the same idea.

ON THE MANUFACTURE OF THE CELEBRATED DAMASCUS BLADES.—Nicolo Milonas, for some time consul in the East, in endeavouring to discover the processes employed by the Kourdes in the manufacture of their sword blades, observed that:—1. The manufactories in which these blades are made are situated at the declivity of the mountains, near cascades, the water of which, falling from rock to rock, arrives in the most limpid state in the reservoirs constructed for its reception, in which reservoirs the blades are tempered. These reservoirs are placed in situations where the air is very pure. These conditions of purity of air and water are considered necessary for the success of the operation. 2. Iron of the purest quality is selected. The metal is subjected to a very high temperature, and the first tempering commenced when the iron is at a white heat; the metal is exposed before fusion, the fuel employed being placed on each side of it; the red-hot iron is then covered as quickly as possible with fatty and oily matters, paste made from bones, wax, &c. This operation tends, according to the manufacturers, to render the blade flexible. The second tempering is performed by the same process, with this difference, that the heated iron, after having thrown off considerable quantities of sparks, and having been exposed, is covered with a paste composed of powdered bones and purified mutton suet. The third tempering is effected by disposing the metal in such a manner that it may be seized by a man on horseback, who rides at full gallop in order that the blade which he keeps in an elevated position may receive the impression of the air. 3. The fuel employed is anthracite and turf. In order to obtain favourable results, it is necessary to use fuel entirely free from sulphur, and combine, as much as possible, the heating of animal, vegetable, and mineral substances.

TO CORRESPONDENTS.

"J. C. L."—Of course you must use fuming nitric acid and fuming sulphuric acid.

"Mr. Richard Goswell, Bristol," is referred to No. 123 of the *Chemical Times*.

"Mr. W. Matthewson, Glasgow."—Phocenine is a fatty principle. It forms one of the constituents of the oil of the porpoise (Delphinum phocæna), in which it is associated with elaïne. Upon saponification it yields a volatile, odorous acid, called "phocenic acid."

"X. Y. Z.'s" contribution is under consideration.

"G. R."—Professor Faraday.

"B."—We are sorry we cannot comply with your request.

"T. C."—Atmospheric air is 815 times lighter than water.

"Mr. John Tarbow."—The work in question is out of print. You will find it no easy task to procure a copy of it.

"Analyst."—Chemically pure concentrated sulphuric acid for chemical experiments and researches is prepared best by the following process:—Pour from three to four pounds of common sulphuric acid into a capacious glass retort, which should be coated over outside with a paste made of clay and cow-hair. Throw a coil of platinum wire or a few fragments of platinum into the retort, and place the latter in a wind-furnace (to be covered subsequently with a cap or helmet). Introduce now the neck of the retort into the body of a large globular receiver without luting. Heat the contents of the retort gradually to boiling, by surrounding it with red-hot charcoal, taking care to make the fire act principally upon the top and sides, and less upon the bottom of the vessel. The acid which passes over first contains an admixture of nitric acid. It is necessary, therefore, to change the receiver after the lapse of some time, in order to obtain absolutely pure acid. The distillation should be continued until about three quarters of the acid in the retort have passed over.

"Mr. W. Williams, Strafford."—Liebig's cyanic acid is prepared by dissolving 100 grains of mercury in an ounce and a half by measure of nitric acid sp. gr. 1.3, and when cold adding by measure two ounces of alcohol sp. gr. 0.849. This is heated till it effervesces briskly, when a detonating compound is formed, which is composed of cyanic acid and oxide of mercury. Wöhler's cyanic acid is obtained by transmitting sulphuretted hydrogen gas through water in which cyanide of silver is suspended. The acid thus formed, however, suffers decomposition a few hours after its formation.

"Mr. Bradshaw, Sheffield."—Cytisin is an alkali found in the seeds of the Cytisus laburnum. It is obtained by digesting the seeds in hot alcohol, evaporating the liquid, dissolving the residuum in water, and adding to the solution acetate of lead. The liquid is then freed from the lead by means of sulphuretted hydrogen, and the fluid again filtered and evaporated. See also Soubeiran's "Course of Practical Pharmacy (Extractive)." Delphia, or Delphinin, is a vegetable alkali found in the Delphinium staphisagria, or stavesacre. To procure it, boil the seeds previously husked, and reduced to a paste, in a little distilled water, strain through linen, and add a little very pure magnesia. Then boil for a few minutes, and filter again; wash the residuum, and digest in highly-rectified spirits of wine; evaporate the liquid, and the delphia will remain in the form of a white, inodorous, very bitter, and acrid powder.

"J. L."—You may procure the "Pharmacopée Universelle" at Mr. Ballière's, of 219, Regent-street.

"Mr. Richard Maxwell, Bolton."—The following is De la Rive's process of gilding:—Pour a neutral solution of chloride of gold, containing about one half to one per cent., and no more, of gold, into a glass cylinder, of which the lower end is hermetically closed with moistened gut-skin, and introduce the cylinder into a vessel containing some water very slightly acidulated with a few drops of sulphuric acid. The cylinder should be supported in a manner to prevent its lower surface resting immediately on the bottom of the larger vessel. It is necessary to scour and clean carefully, or even to polish, the surface of the metal (whether silver or brass) which it is intended to gild, lest a portion of it should be left ungilt. To attain this end it is sometimes advisable to place the metal for a few moments in contact with zinc in dilute sulphuric acid, so that hydrogen may be disengaged on its surface; after which it must be well washed. If you wish to gild an object, fix or suspend it by a platinum wire, to the other end of which is attached a zinc plate; now plunge the article to be gilt in the solution of gold, and immerse the zinc plate in the acidulated water. The power of the electric current may be moderated at will by immersing more or less of the zinc plate, so that no hydrogen may be disengaged, in which case the chloride of gold alone is decomposed. After about a minute's immersion the article to be gilt is withdrawn, wiped dry with a fine linen cloth, rubbed a little, and again immersed. After two or three immersions the metal will be found sufficiently gilded.

"T. S." will receive a private communication.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—February 17, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLVI.

(LECTURE LXXIV.)

EXTRACTIVE.

SECTION IV.—EXTRACTIVE ASSOCIATED WITH ESSENTIAL OIL.

This series comprises a great variety of medicinal agents. Some of them, *e.g.*, the flowers of the linden, melilot, and elder, are little more than odorous; others, such as the vanilla, for instance, saffron, the seeds of the ombelliferous plants, have more active properties; in a third class the extractive has a very decided special action of its own. To this class belong the white rose and the sumach (Rhus radicans).

THE FLOWER OF THE LINDEN TREE.

The flower of the linden-tree (Tilia europæa) contains:—

An odorous volatile oil,
Tannin which colours iron salts green,
Sugar,
A considerable proportion of gum,
Chlorophyle,

M. Brossat recommends the following method for the preparation of the volatile oil of the linden flower:—

Distil 100 pounds of the flowers with a sufficiency of water to obtain 80 pounds of distillate. Redistil the product of the first distillation over a fresh supply of 100 pounds of flowers, and draw off 40 pounds of product. You will find a number of globules of volatile oil of a fine gold-yellow colour floating on the surface of the distillate.

M. Brossat having drank some of this distilled water experienced a species of merry intoxication, combined with a quite peculiar excitement. That the distilled water of the linden flower possesses intoxicating properties has been fully confirmed by Pfaff and others.

The volatile principle is found both in the distilled water and in the infusion of linden-flowers, and it is to its presence that these preparations owe their antispasmodic properties.

DISTILLED WATER OF LINDEN FLOWERS.

Take of Recently gathered and carefully-dried linden flowers, 1 part.
Water, a sufficiency.

Distil, to obtain 4 parts of product.

The linden-flower-water prepared with the dried flowers is milder than that prepared with the fresh flowers.

MELILOT.

(*Melilotus officinalis.*)

We use in medicine the tops of the flowers of melilot. The flowers of melilot have an agreeable odour, resembling that of the tonka-bean.

The tops are gathered, put in small paper bags, and dried. The dried flowers smell sweeter and stronger than the fresh flowers.

The tops of the melilot flowers contain a concrete volatile oil (stearoptene), which Vogel, who discovered it first, mistook for benzoïc acid; it has been studied since by M. Guillemette, who found it to be perfectly identical with coumarin, the odoriferous principle of the tonka-bean.

Coumarin is white; it crystallizes in square needles, or in short prisms. It has the aromatic odour of the melilot. It has a hot pungent taste, with agreeable aftertaste. Its density exceeds that of water. It is fusible and volatile. It is sparingly soluble in cold water. Boiling water dissolves it readily; from the solution in the latter menstruum it crystallizes upon cooling. It is very soluble in alcohol and in ether. It has neither an acid nor alkaline reaction. Its composition may be represented, according to M. Henry, by the formula:—

$$C_{10}\,H_3\,O_2.$$

The distilled water of the melilot flower contains coumarin; but this principle may be obtained more conveniently by the direct action of alcohol upon the flowers of melilot.

The flowers of melilot are used as a resolutive agent, principally in slight inflammations of the eyes. We employ the infusion or the distilled water.

DISTILLED WATER OF MELILOT FLOWERS.

Take of Dry tops of melilot flowers, 1 part.
Water, a sufficiency.

Distil in the steam apparatus, and draw off four parts of product.

The dry flowers yield a more agreeably-scented water than the fresh flowers.

OIL OF MELILOT.

Take of Dry melilot flowers, 1 part.
Olive oil, 8 parts.

Digest in the water-bath for two hours; strain with expression, and filter.

ELDER FLOWERS.

The flowers of the elder (Sambucus nigra) are considered to possess diaphoretic properties. The infusion (prepared with 4 grammes of the dry flowers per quart of water) is frequently prescribed by physicians as a sudorific. It is also used in fomentations as a resolutive agent. For the latter purpose the infusion is made much stronger (10 to 12 grammes of the flowers per quart of water). The flowers are also used for resolutive poultices.

The fresh flowers exhale a nauseous odour; after desiccation the odour is more agreeable.

The distilled water of elder flowers is frequently used as the basis of resolutive collyria.

DISTILLED ELDER-FLOWER-WATER.

Take of Fresh or dry elder flowers, any quantity you like.
Water, a sufficiency.

Distil in the steam apparatus, and draw off four times the weight of the flowers of product.

According to Gleitzman, elder-flower-water contains a considerable proportion of ammonia, and produces copious precipitates in solutions of bichloride of mercury and of acetate of lead.

WHITE ROSES.

We have already seen that the juice of the white rose (Rosa semperflorens and Rosa centifolia) possesses laxative properties.

The white rose is used principally, however, for the volatile oil which it contains.

The essence of roses is prepared in the East by distilling the flowers of the Rosa moschata, Rosa sempervirens, and Rosa centifolia. It is yellow, and has the consistence of butter. It melts at 82.4 to 86° Fahrenheit. Its density is 0.832. It is sparingly soluble in cold alcohol. It consists of a mixture of a liquid oil with a stearoptene; the composition of the former is unknown. The stearoptene contains one equivalent of carbon and one equivalent of hydrogen. It is white, crystalline, very soluble in ether and in the essential oils, and fuses at 95° Fahrenheit.

ROSE-WATER.

Take of Roses, any quantity you like.
Water, a sufficiency.

Distil in the steam apparatus, and draw off an equal weight of product to that of the flowers used.

The Rosa semperflorens yields a milder and more agreeably-scented water than the Rosa centifolia.

ROSE-SYRUP.

Take of Distilled rose-water, 100 parts.
White sugar, 180 parts.

Dissolve cold, and filter.

ROSE-SPIRIT.

Take of Rose leaves,
Alcohol of 88 C. (34° Cartier), of each equal parts.

Bruise the leaves, put them in the water-bath of an alembic, add the alcohol, keep macerating for one or two days, and distil off an equal weight of product to that of the alcohol used.

The solution of the essence of roses in rectified alcohol is preferable to the distilled spirit of roses.

SAFFRON.

(*Crocus sativus.*)

Saffron is used in small doses as a tonic and stomachic; in larger doses it acts as a powerful stimulant. It seems to exercise a decided action upon the nervous system.

Saffron contains:—

Volatile oil,
A peculiar colouring matter,
A considerable proportion of mucilage,
Vegetable albumen.

The medicinal properties of the saffron seem to reside in the volatile oil.

The colouring matter has been called polychroite by MM. Bouillon-Lagrange and Vogel. The powder of polychroite has a scarlet-red colour and a bitter taste. It colours saliva yellow. It is very sparingly soluble in cold, much more readily in boiling, water. It dissolves readily in alcohol and in the fixed and volatile oils, but less readily in ether. Sulphuric acid changes its colour to blue, and subsequently to lilac; nitric acid to a grass-green tint: dilution of the fluids causes these colorations to disappear.

POWDER OF SAFFRON.

Dry the saffron in the stove, and reduce it to powder without leaving any residue.

INFUSION OF SAFFRON.

Take of Saffron, 2 grammes.
Boiling water, 1,000 grammes.

Let the saffron infuse in the water for one hour; strain.

ALCOHOLATE OF SAFFRON.

Take of Saffron, 1 part.
Alcohol of 88 C. (34° Cartier), 16 parts.
Water, 4 parts.

Let the saffron infuse in the alcohol; add the water, and distil off 16 parts of alcoholate.

TINCTURE OF SAFFRON.

Take of Saffron, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Let the saffron macerate in the alcohol for fifteen days; strain with strong expression, and filter.

EXTRACT OF SAFFRON.

Take of Saffron, 1 part.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Let the saffron macerate in the alcohol; strain off the alcoholic fluid, and let the grounds macerate again in a fresh quantity of alcohol. Strain again, and add the product of the second to that of the first maceration. Distil off the whole of the alcohol, and evaporate the residue to the consistence of an extract.

One part of the extract is equal to two parts of saffron.

SYRUP OF SAFFRON.

Take of Saffron, 1 part.
Malaga wine, 16 parts.
Sugar, 24 parts.

Let the whole macerate in the wine; strain with expression; filter, and dissolve the sugar in the filtrate, in a covered water-bath.

Ten grammes of syrup represent 25 centigrammes of saffron.

VANILLA.

(*Vanilla aromatica.*)

Vanilla is used occasionally as a tonic and powerful stimulant.

It contains, according to Bucholz:—

A fatty oil,
Soft resin,
A slightly bitter extractive matter,
A peculiar extractive matter,

Apothema,
Sugar,
Amyloïd matter,
Benzoïc acid,
Vegetable fibre.

The fatty oil has a rancid taste and disagreeable smell. The resin is soft, and exhales, when heated, a feeble vanilla odour.

The peculiar extractive matter greatly resembles tannin. It strikes a green precipitate with salts of iron. It does not precipitate gelatine.

With respect to the benzoïc acid, the crystals, which Bucholz considers as such, are not acid.

Bucholz says, vanilla yields no volatile oil upon distillation; it is certain, however, that it contains volatile oil.

POWDER OF VANILLA.

Take of Vanilla, 1 part.
Sugar, 4 parts.

Cut the vanilla in small pieces, and pound them in an iron mortar, together with a portion of the sugar. Pass through a silk sieve, and pound the residue again with a fresh portion of sugar. Sift again, and repeat the same operation until the whole of the vanilla is reduced to powder.

VANILLA LOZENGES.

Take of Vanilla, 1 part.
Sugar, 7 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of 40 centigrammes each.

Each of these lozenges contains 5 centigrammes of vanilla.

TINCTURE OF VANILLA.

Take of Vanilla, 1 part.
Alcohol of 80 C. (31° Cartier), 8 parts.

Let the vanilla macerate in the alcohol for eight days; strain with expression, and filter.

ALCOHOLATE OE VANILLA.

Take of Vanilla, 4 parts.
Carbonate of potass, 1 part.
Alcohol of 80 C (31° Cartier),
Water, of each 64 parts.

Let the vanilla and the carbonate of potass macerate for twenty-four hours in the alcohol. Add the water, and distil off 15 parts of product.

SASSAFRAS.

Sassafras is the root of Laurus sassafras, a North American plant.

It has a strong smell from the essential oil which it contains. This oil is liquid, and of greater density than water. It has an acrid taste. It boils at 442.4° Fahr. In the course of time it deposits a stearoptene in four or six sided prismatic crystals. This stearoptene is so fusible that the heat of the hand suffices to melt it.

When the oil of sassafras is treated with nitric acid it acquires a lively orange-red colour. According to M. Saint-Evre, its composition may be expressed by the formula :—

$$C_{20}\,H_{10}\,O_4.$$

Sassafras is used as a diaphoretic and diuretic agent, principally in venereal diseases, rheumatism, and gout.

INFUSION OF SASSAFRAS.

Take of Sassafras-root, 16 grammes.
Boiling water, 500 grammes.

Let the root infuse in the water; strain.

DISTILLED WATER OF SASSAFRAS.

Take of Sassafras, 1 part.
Water, 8 parts.

Distil off 4 parts of product.

SYRUP OF SASSAFRAS.

Take of Sassafras, 1 part.
White wine, 7 parts.
Sugar, 10 parts.

Grate the root, and let it macerate in the wine for five or six days; strain, and form a syrup by simple solution.

SEEDS OF THE OMBELLIFEROUS PLANTS.

The seeds of the ombelliferous plants contain a small emulsive grain, from which a fixed oil is extracted; the outer part, however, formed by the cup and pericarp, is of much greater importance in a medicinal point of view, from the abundant proportion of volatile oil which it contains, and which imparts a strong aromatic odour to the seeds.

The seeds of the ombelliferous plants are employed as stimulants and carminatives.

The species most commonly used are :—

Pimpinella anisum,
Anethum graveolens,
Sison ammi,
Carum carvi,
Coriandrum sativum,
Cuminum cyminum.
Athamanta cretensis,
Fœniculum vulgare,
Phellandrium aquaticum.

The Essence of Anise is colourless; it concretes at 50°, and liquefies only at 62.6 Fahrenheit. It dissolves in all proportions in anhydrous alcohol, but is less soluble in weak alcohol. The stearoptene constitutes about the fourth part of the weight of the oil; it is friable, and less volatile than the fluid part; it fuses at 68° Fahrenheit.

The stearoptene of anise is composed of

$$C_{20}\,H_{24}\,O_2.$$

The Essence of Fennel is colourless or yellowish. It congeals at 50° Fahrenheit. Its stearoptene has the same composition as that of the anise.

The fluid oil, according to M. Cahours, is composed of two different oils, of which the one, the less volatile of the two, has the same composition as the solid stearoptene; the other, the more volatile of the two, is isomeric with the essence of turpentine.

The Essence of Cummin is yellowish, highly fluid, and very acrid. According to MM. Gerhardt and Cahours, it consists of a hydrocarburetted essence (cymene), which exhales the odour of the lemon, and boils at 229° Fahrenheit, and an oxygenated essence, of which the properties are greatly analogous to those of hydruret of benzoyle.

The Essence of Caraway is yellowish brown, and highly fluid. Its density is 0.938. It boils at 101° Fahrenheit. According to Schweizer, it is a compound of two oxygenated essences, of which the one boils at 379.4, the other at 442.4° Fahrenheit.

The Essence of Dill (Anethum graveolens) has a pale yellow colour, and a sweet, afterwards pungent, taste. Its density is 0.881.

The Essence of Coriander is colourless and highly fluid. Its density is 0.759.

CARMINATIVE SPECIES.

Take of Anise,
Caraway,
Coriander,
Fennel, of each equal parts.

Mix.

POWDER OF ANISE
(Or of any of the Analogous Seeds).

Dry the seeds in the stove, and reduce them to powder, leaving about one sixth residue.

INFUSION OF ANISE
(Or of any of the Analogous Seeds).

Take of Anise, 8 grammes.
Boiling water, 1,000 grammes.

Let the seeds infuse in the water.

The infusion of Phellandrium aquaticum is recommended in pulmonary consumption.

TINCTURE OF ANISE (&c.).

Take of Anise, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

F.S.A.

ELÆOSACCHARUM OF ANISE (&c.).

Take of Essence of anise, 1 drop.
White sugar, 4 grammes.

Mix.

DISTILLED WATER OF ANISE (&c.).

Take of Anise, 1 part.

Grind the seeds in the mill; distil in the steam apparatus, and draw off four parts of product.

ALCOHOLATE OF ANISE.

Take of Anise, 1 part.
Alcohol of 56 C. (21° Cartier), 8 parts.

Distil off six parts of alcoholate.

SUMACH.

(*Rhus radicans.*)

All the species of the genus Rhus are remarkable for their deleterious action. The air in the vicinity of these plants is rendered unwholesome by the emanations which rise from them. Desiccation or coction tends to dissipate the deleterious principle.

Van Mons found that these plants exhale, in the shade, hydrocarburetted gas. According to this chemist, Rhus radicans contains :—

Tannin,
Acetic acid,
A little gum,
A little resin,
Chlorophyle,
A hydrocarburetted principle,

The acrid properties of the plant reside, according to Van Mons, in the hydrocarburetted principle.

Van Mons omits to mention a matter which exists in the leaves of Rhus radicans, and which turns black in the air, and equally when acted upon by nitric acid or chlorine. This coloration is attributable perhaps to a phenomenon of oxidation of some colouring matter. When the expressed juice is exposed to the air, black pellicles form on the surface. It would appear that this phenomenon of coloration is no longer observed after the plant has been dried.

It is probably an analogous matter which exists in the juice of the Comocladia, of the Rhus vernicifera of Japan, and of the Melannorrhœa usitata of Nepaul, of which the black and brilliant juice furnishes a fine varnish, according to Wallich.

None of the preparations of Rhus radicans, obtained by desiccation, or coction, or infusion, possess the poisonous properties of the living plant.

The pharmaceutical preparations of Rhus radicans are recommended against paralysis and tetters.

The decoction of the root is used in America as a gargle to stop mercurial salivation.

POWDER OF RHUS RADICANS.

Reduce the dry sumach leaves to powder.

This powder is said to have been exhibited with good success in paralysis, at the dose of 60 centigrammes (from 10 to 15 centigrammes at a time).

INFUSION OF RHUS RADICANS.

Take of Fresh sumach leaves, 4 grammes.
Boiling water, 1,000 grammes.

Let the leaves infuse in the water.

EXTRACT OF SUMACH.

This extract is prepared with the non-depurated juice of the plant. The operator must wear gloves and a mask, to shield himself from contact with the juice.

Having taken these precautions, put the leaves in a marble mortar, and pound them with a wooden pestle; add a small quantity of water. Squeeze out the fluid; pour it on plates in thin layers, and evaporate in the stove.

With regard to the efficacy of this extract opinions are divided. Some look upon it as poisonous, others deny that it possesses any property. I, for my own part, am convinced that the extract has by no means the energetic action of the plant.

Dr. Guéneau has exhibited it (prepared most carefully by myself) in the Hôtel Dieu, at the dose of 1 gramme, without hardly producing the slightest effect.

The extract of sumach, combined with chloride of barium, is used against tetters.

ALCOHOLIC TINCTURE OF SUMACH.

Take of Dry sumach leaves, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the leaves macerate in the alcohol for fifteen days; strain with expression, and filter.

The following formula yields a much stronger product, which contains also the volatile acrid principle, and should never be given except upon the express prescription of a physician :—

Take of Fresh sumach leaves,
Alcohol of 86 C. (34° Cartier), of each equal parts.

Bruise the leaves, and let the bruised mass macerate in the alcohol for from twelve to fifteen days ; strain with expression, and filter.

CORSICAN MOSS.

The Corsican moss, or Helminthocorton, is a mixture of Fucus helminthocortos with several other species of seaweeds.

According to M. Bouvier's analysis, Corsican moss contains :—

Gelatine,
Sulphate of lime,
Sea-salt,
Carbonate of lime,
Carbonate of iron,
Carbonate of magnesia,
Phosphate of lime.

The nature of the gelatinous matter is not well known.

Corsican moss is used as a remedy against intestinal worms.

POWDER OF CORSICAN MOSS.

Beat the moss on a table with a spatula, to detach the earthy parts which adhere to it. Sift, and repeat the operation once more. Dry the clean moss, and reduce it to powder.

INFUSION OF CORSICAN MOSS.

Take of Corsican moss, 16 grammes.
Boiling water, 160 grammes.

Let the moss infuse in the water ; strain.

The Corsican moss is also occasionally treated by maceration or by decoction.

The products of the infusion and maceration are more aromatic than that of the decoction.

SYRUP OF CORSICAN MOSS.

Take of Corsican moss, 1 part.
Sugar syrup, 5 parts.

Pour two parts of tepid water over the moss, and let it macerate for twenty-four hours. Squeeze out the fluid under the press, and filter. Pour one part of tepid water over the residue ; let it macerate again for twenty-four hours ; strain with strong expression, and filter.

Add the product of the second maceration to the syrup, and boil. When the syrup has lost by evaporation a weight equal to that of the product of the first maceration, add the latter promptly and rapidly, and strain.

This syrup is very clear and aromatic.

Some practitioners prefer the syrup prepared with the decoction of the moss. I find it, however, less limpid and aromatic than that prepared in the manner just now described. If you wish to prepare your syrup with the decoction you have simply to mix the decanted decoction with sugar syrup, and to clarify by filtration through paper.—(Desmarets' Method.)

M. Deschamps prepares his syrup of Corsican moss by simple digestion of the moss, and solution of the sugar in the liquid.

JELLY OF CORSICAN MOSS.

Take of Corsican moss, 8 parts,
Sugar,
White wine, of each 16 parts.
Isinglass, 1 part.

Boil the moss for one hour in water ; strain with expression ; let the liquid settle, decant, add the white wine, the sugar, and the isinglass, and boil to the consistence of a jelly.

The isinglass is here a necessary ingredient, since without it the jelly would only have a mucilaginous consistence. M. Recluz recommends the substitution of Carragheen for the isinglass. He uses equal parts of Corsican moss and of Carragheen, and boils them together.

M. Béral takes
200 parts of syrup of Corsican moss,
100 parts of alcoholic solution (jelly) of isinglass.
He reduces the mixture to 250 parts by evaporation.

SACCHAROLATE OF CORSICAN MOSS.

Take of Corsican moss, 4 parts.
Sugar, 8 parts.
Orange-flower-water, 1 part,

Boil the moss in water for two hours. Strain, let the liquid settle, decant, and evaporate. When the process draws to its close add the sugar and the orange-flower-water, and complete the desiccation at a gentle heat, or in the stove.—(Deschamps.)

CORSICAN MOSS LOZENGES.

Take of Saccharolate of Corsican moss, 15 parts.
Gum arabic, in powder, 1 part.
Mucilage of gum tragacanth (flavoured with lemon), a sufficiency.

Mix, and make into lozenges of 1 gramme each. Keep them in well-stopped bottles.—(Deschamps.)

WHITE CORAL.

The white coral (Corallina officinalis) is a small polypus found in the Mediterranean. It is formed of carbonate of lime and animal matter. The latter constituent it contains in a larger proportion than the red coral.

It is used as a vermifuge.

It is administered in powder, at the dose of 1 to 2 grammes.

VOLTAIC IGNITION.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION, FEB. 16, 1849.

By Professor W. H. GROVE, Barrister-at-Law, Author of "The Correlation of Physical Forces."

It is now nine years since I first communicated to the members of this institution my views of some of those powers derived from the voltaic battery which had previously been applied here in a less degree by Davy, and which lately have attracted in a marked manner the attention of the public ; and four years ago I communicated at one of these evening meetings my views on some of the remarkable phenomena connected with the voltaic arc. I then exhibited a voltaic light obtained by means of what I believe was the most powerful battery then or since brought before an European audience. To-night I am about to take up the same subject in a different point of view, and consider first some other phenomena of ignition excited by means of the voltaic battery, and I had intended to confine myself to a strictly scientific treatment of that subject ; but, as I am informed that many present are exceedingly anxious that it should be treated in a popular and experimental way, I shall regard that wish, and be governed as to the rest by the amount of time at my disposal. If each separate individual whom I now address were asked to define his own impression of the nature of heat, it is probable that no two answers would be alike. We are so blinded by our own sensations, which may possibly be as different as our countenances are dissimilar, that no agreement can be expected in such a case. But if we reflect on our sensations, and obtain certain views of their cause, making abstraction of all but the purely mental phenomena, a most difficult point, and so get a general idea of what heat is, this must be one which expresses it as a repulsive power. The varied sensations we feel, removed as they may appear to be from this simple idea, the burning which a great heat produces on the frame, the burning sensation which excessive light causes on the eye, all depend on certain physical affections of the respective organs, which, when the construction of those organs, and every other essential circumstance, is taken into account, can only be resolved by the action of this power of repulsion which we call heat. With one exception we may say that the effect of heat upon all matter is to extend it in space, by driving or expelling its molecules to a distance from one another. By the older experimentalists this was believed to apply only to matter brought into proximity with the source of heat ; but recent investigations have shown us that this repulsive power can be extended to considerable distances, and be made to act where none of the primary sensations of heat can be felt. Fresnel placed two metallic laminæ near each other in vacuo, and, projecting a solar beam on them, found that they became separated and removed to a perceptible distance. Professor Baden Powell, of Oxford, also has carried out the same views by observations on the effect of an increase of temperature on Newton's rings. There is one exception, however, to the repulsive character of the force we call heat, and it obtains in many bodies, particularly in those which assume a crystalline form on cooling. Water, for instance, if heated to its boiling point will expand like other liquids, and if then allowed to cool will be found to contract its bulk steadily until it attains the temperature of 40° F., at which point it will attain its maximum of density. On continuing to diminish its temperature the water will commence dilating in bulk until it attains the freezing point, or 32° F. ; and, if it be cooled below this point without freezing, by avoiding all agitation it will continue to expand, but, left to itself, water will crystallize at 32° F., and its bulk, instead of being diminished by abstraction of heat, will positively increase. This has been attempted to be explained by supposing that at 32° water has a tendency to assume a polar state, that the particles place themselves in an antagonistic position something like a chevaux-de-frieze, and that thus they are compelled to occupy a larger space. The exception obtains in several bodies besides water, but, after allowing for it, we may regard heat as properly a repulsive force producing the expansion of matter. Now, how is this expansion of matter produced ? We know that it is communicable. When a heated body is placed near another cooler body heat will leave the former and enter the latter, tending to bring about an equilibrium. In the last lecture I delivered here I showed what was the nature of the communication of expansive force from one body to another. We find a great variety in the means by which heat may be generated as well as communicated. There is first of all solar heat ; another, much more generally understood, is that by means of which all our culinary operations are conducted. A very large proportion of heat is realized by chemical action. This as far as we have been able at present to go into molecular friction ; there are many differences of opinion on the subject, and certainly we hope to learn very much more than we at present know of it. It is this heat we shall consider more particularly this evening. If I take a chemical substance containing ingredients capable of combining at the heat of combustion, and bring them into a suitable condition, they will generate heat in different degrees, according to the vigour with which they chemically unite, and according to whether the production of heat is antagonized by any physical power. Take any two such bodies, a small quantity of gunpowder for instance, containing two ingredients in a favourable mechanical condition for permitting their combination, and the moment they are made to do so heat is generated, and they are able at once to come within the sphere of attraction. Now, by the discovery of Volta we have given us a power of transferring chemical force. That force which we have just seen acting at small distances, and causing the molecules of bodies capable of combination to approach each other, we can transfer and make it pass through bodies, wires for instance, or the human body even. We can make the power not only pass through but develop at the remote termini the same amount of chemical force, and decompose or resolve bodies into their elements, just as if we had the substances in question in close contact. When the voltaic battery is in action all the force is arranged in one direction in the circuit. To produce chemical combination by this means, by

throwing, as it were, all the action into one direction, we can change the *locale* of our force, or make all combination take place through bodies in exactly equivalent quantities to the amount of chemical action going on in the trough. In the battery we have zinc and sulphuric acid undergoing chemical change, and in each of these cells I can tell the exact amount of chemical combination which is taking place. Chemical combination, I have said, is one of the main sources of heat. If we can transfer the power of combination, it is natural to suppose that we should be able to transfer the heat which results from combination. The next question then is, whether the conductors, wires, the human body, &c., have transferred through them this same igniting power? And here a very few and simple experiments will enable us to dispose of this question. In the next experiment I take a piece of zinc and platinum, connecting them with the battery, and as soon as I cause the two metals to touch each other chemical action takes place, and at the point of contact heat is developed, which will be more manifest if we contract the circuit. Now, to carry out this further, we will take a larger apparatus. Instead of having a point of platinum, which developes the heat by touching, I elongate that point, and so contract the circuit, and get a higher degree of ignition. In these experiments we find we want a certain amount of conducting power in the wire and a certain amount of resistance. Take another experiment. Here I have a little chain, the links of which are made of platinum and silver, which are placed alternately. When we place this compound chain in the circuit, the platinum links immediately become highly luminous, while the silver continues dark, and we have an alternation of black and white bands. The reason of this is that the silver is a good conductor, and the electricity is conveyed from it to the platinum, which resists its passage, and thus heat and light are produced. But the external circumstances under which this force is exerted on a body are not less important to the effect than its own properties. That platinum wire, had I subjected it to the voltaic force under a jar of hydrogen, would have shown you no visible effect of ignition. Any person experimenting originally under such an atmosphere would have required a vastly greater power to have enabled him to discover it at all. Just let me make this plain. Here are two platinum wires; one is placed under a jar containing atmospheric air, the other under a jar filled with hydrogen; both wires are alike under the action of the voltaic current; and now observe that while the former, placed in air, is rendered quite luminous, having ignited, that which is placed in hydrogen is not at all visibly affected.

This fact shows us that we are too apt to consider phenomena abstractedly and apart from the circumstances under which they take place. Hydrogen is not the only gas which produces this effect. If time served I might multiply such cases. In all probability the theorists would tell us that this difference was produced by molecular action, and would not imagine that the external atmosphere was concerned; perhaps they would be further led to do so if with the rarity of the surrounding air the power of ignition increased. In that case hydrogen would increase ignition, and the wire would be fused; but we find a state of things totally the converse of this supposition.

I have taken considerable pains to ascertain the reason of this peculiar fact, and, without going into a long series of experiments, I may say it does not depend on the rarefied state of the air, because it is the same whether we take hydrogen or carbonic acid gas; nor does it depend on specific heat. As far as I could ascertain it depends on the molecular cooling effect which may be produced, whether from the peculiar fluent character of hydrogen, which I may be allowed to illustrate by comparing its relation to air in point of mobility to that of oil to water, the particles of hydrogen moving so quickly on the surface of the bodies it surrounds as to convey off with great rapidity the heat which they receive, or else to a mere state of surface producing a specific effect related to the phenomena of radiant heat, as if hydrogen were to atmospheric air as black to white, one of which conveys the radiations away more rapidly than the other. These considerations would become of first-rate importance in any attempt to apply this light to mines, as we may conceive that a number of these luminous points might be scattered through the works and act very well until the character of the subterranean atmosphere gradually underwent a change, when through the predominance of hydrogen gas they would be extinguished. The cooling properties of hydrogen have various other effects on flame, some of which may be interesting. Pass a lighted jet of oxygen into a body of hydrogen and it burns with a diffused, large flame; the large hydrogenous atmosphere cools the flame; but, when a jet of hydrogen is made to burn in oxygen, the flame is long, narrow, and bright; combustion takes place with greater vehemence, and light and heat are produced with greater vigour. Oxygen has been termed a supporter of combustion, and distinctions have been made between supporters and combustible bodies. This mode of speaking may have been allowable at an earlier stage of scientific inquiry, but if tolerated now it must be with the full knowledge that the distinction has no actual foundation. Combustion is chemical combination attended with light and heat; both the bodies are equally concerned in producing these two phenomena, and we may as well call one the combustible as the other. The heat and light which we see may appear to proceed from only one of the combining bodies, the combustible; but this is mere appearance: the hydrogen which we fired in a jar of oxygen seemed to give out the heat and light, but so did the oxygen when we placed it in a jar of hydrogen. Heat and light were in each case derived from the combination of oxygen with hydrogen. Now, on account of the rapidly-cooling action of hydrogen we are unable to burn atmospheric air in that gas; but if we take a gas which has not this cooling effect we can actually produce this effect. I will take phosphorus, and, placing a little in a flask, will heat it over a small lamp so as to get the flask filled with phosphoric vapour. When this is done I will insert a small tube, and, blowing into it, I shall be able to burn the carbonic acid gas exhaling from my lungs, and so realize the old fable of burning breath. Now to return to the voltaic discharge.

The difference between ordinary chemical action and voltaic chemical action appears to be that in the latter case the force is polarized and made to pursue a certain line of action, while in the former no such determination can be recognised. That power which has place in ordinary combustion we can command in the polar form in voltaic combustion. The common flame bears the same relation to the voltaic ignition as ordinary chemical combination bears to combination transferred by means of the voltaic battery. If I bring the two series of the voltaic battery together they have an attractive influence on one another, but of course that material is much too dense to admit of its becoming sensible. If I suspend two pieces of gold leaf, which are far more delicately sensitive, I can make them, by approaching the ends of the wire, draw near each other, and they take fire. Now, if instead of having solid terminals I have liquids, fused metal instead of solid metal, these, for the same reason, will attract each other. If I place the copper wires terminating the conductors of the battery in an atmosphere of nitrogen I can get the copper up to a very high degree of temperature, and a steady incandescence is observed; but if I take hydrogen I can only get scintillations of light instead of continuous ignition. I will now exhibit the phenomenon commonly known as the voltaic arc. In this experiment charcoal points are used, as this material disintegrates much better than copper. In this experiment we get not only the most intense light, but the heat is the greatest with which we are acquainted; it fuses everything we can find, and nothing has hitherto been able to stand against it. I have seen platinum and iridium both melted down like butter under this fierce heat. There are several very beautiful practical applications of this power which I should wish to bring before you. One of these is the facility of analysis by voltaic ignition. It is obvious that with the power of igniting a body without applying local heat we can carry on operations in closed vessels, a tube for instance, where it might be undesirable to proceed in any other way. But, however, to pass from laboratory considerations to the electric light. How far is that practically adapted to illuminating purposes, and what appears to be its capabilities? Now, it is a very dangerous thing for a man to set up for a prophet; scientific predictions are as often falsified as fulfilled; and it is scarcely safer to say what will not than what will be, especially when we undertake to set bounds to the inventive and penetrating powers of the human mind; nevertheless, a man does reflect on these matters, and form his opinion respecting them, and if expected to speak he must speak as he thinks. About seven years ago I made some experiments on this same subject, and, in anticipation of this evening's occupation, I yesterday repeated them with a battery of fifty cells, and these are my results. As far as I am aware, with the exception of mechanical details, we have had no greater power of producing light now by the voltaic battery than we had when I made my first experiments; I believe I may state as much. The nitric acid battery is the only one at present known that offers any thing like a power for bringing this light to bear, and I am not aware of any material improvement in that during the last seven years. The subject was well investigated in Davy's time, although the battery was not then so constant as now. Now, if I were to withdraw one of the pieces of zinc while the action of the battery was going on I should find it was diminishing in weight; and in a good battery, properly handled, the diminution which takes place in one piece of zinc would be the same in amount for all the rest. It would consume the same amount of sulphuric acid and the same amount of nitric acid. If I chose I could measure the amount of expenditure taking place in the trough by the amount of gas produced, and of decomposition going on. I could then tell exactly how much zinc was being consumed in each cell, how much sulphuric acid and how much nitric acid. Now, in the experiments and calculations I have made, I find that a battery of thirty cells would cost in zinc and the two acids as nearly as possible 2s. per hour. But then, of course, there are other expenses which must be reckoned. There would be some mercury consumed, there would be the expense of preparing the battery, and a number of other charges which will suggest themselves to those who are in the habit of using voltaic batteries. Upon the whole, I cannot see how the light, such as we have it at present, can be furnished at an expense of less than from 3s. to 3s. 6d. per hour.

The next consideration is the amount and intensity of light yielded at this cost. This I calculated by the old system, which, perhaps, is, upon the whole, the best, namely, by the shadow. I took a piece of wire and a piece of paper and calculated from the distance of the light from the shadow.

The general law of radiant forces is well known, and, according to this, the intensity of the light diminishes as the square of the distance of the luminous body. Thus, if a single candle illuminates a body to a certain extent at the distance of one foot, it would require four candles at a distance of two feet, and nine at three feet, to produce equal illumination. Calculating according to this law, I found that this light from a battery of thirty cells was equal in intensity to that of 1,444 wax candles. Dr. Hare, of America, made similar experiments, and found

the light from a larger battery to be about that of 1,600 wax candles. Now, it appears that, if we can get the light of 1,400 wax candles for 4s. per hour, we have obtained an advantage. But this is not all; we have considerable difficulty in getting the light constant and steady. We have also great commercial difficulties which we do not encounter in the laboratory. I will not say how near we are to the practical application of this light; but I will say I was much less hopeful before I repeated my experiments yesterday than I am now, The earlier experiments did not seem to me so promising as the later. Whether it was because I had acquired a greater command over the battery I cannot say. On the whole I do think that, if it is not permitted to us to see this light in common operation, it may be to our children. I do not see why it should not at once be applied for lighthouse purposes. Its intermittent character would be no objection to it. There are many of the lights now in use revolve, and are therefore intermittent; to any one observer the intervals might easily be regulated, and thus a stream of the brightest light we know could be thrown across the ocean for the guidance of the mariner.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ACTION OF NITRO-SULPHURIC ACID (A MIXTURE IN EQUAL PROPORTIONS OF FUMING SULPHURIC AND FUMING NITRIC ACIDS) ON ORGANIC SUBSTANCES.

By M. AUGUSTUS CAHOURS.

[*Concluded from page* 203.]

ACTION OF NITRO-SULPHURIC ACID UPON BENZOIC ACID.

If benzoic acid is boiled with concentrated, or, better, with fuming, nitric acid, it exchanges one equivalent of hydrogen for one equivalent of hyponitric gas, and a new compound is formed, viz., nitrobenzoic acid, which was first discovered by Mulder.

By using instead of the fuming nitric acid the nitro-sulphuric mixture, and maintaining the ebullition for about an hour, I have succeeded to substitute two equivalents of hyponitric gas for two equivalents of hydrogen, and to obtain a new compound, which I propose to call *binitrobenzoic acid*.

To produce this new compound the nitro-sulphuric mixture is heated to from 122° to 140° F., and fused benzoic acid gradually projected into the liquid; the benzoic acid dissolves, the solution being attended with slight disengagement of gas. When the solution of the benzoic acid is completed, the liquid is gently heated until it commences to get turbid; it is then allowed to cool; water is now added to the refrigerated liquid, whereupon yellowish flakes separate, which turn subsequently white upon being washed. When the washings cease to manifest an acid reaction, the solid product is compressed between folds of blotting-paper, and subsequently dissolved in boiling alcohol.

The alcoholic solution deposits the new product, upon cooling, in form of small and very brilliant crystals, which are then finally purified by repeated recrystallization from alcoholic solution.

Binitrobenzoic acid fuses at a moderately high temperature. When heated gently in a retort it sublimates, without suffering alteration, and condenses on the cold sides of the retort, in the form of fine needles. Cold water dissolves only traces of it; it is somewhat more readily soluble in boiling water. From its solution in the latter menstruum it is deposited again, upon cooling, in the form of small and thin needles. It is tolerably soluble in alcohol and in ether, more particularly if these menstrua are boiling.

It dissolves in large proportion in hot nitric acid, and is deposited again from the solution, upon slow and gradual refrigeration, in the form of hard and brilliant crystals.

Concentrated sulphuric acid dissolves it at a gentle heat, and decomposes it at a higher temperature.

Binitrobenzoic acid forms with potass, soda, and ammonia, soluble and crystallizable salts, which are produced in the direct way, by saturating the acid with either of these bases.

With the oxides of lead and silver it forms salts of sparing solubility; these salts are obtained by the method of double decomposition.

The analysis of the binitrobenzoic acid gave the following results:—

I. 0.556 grm. of substance yielded 0.102 of water and 0.806 of carbonic acid.

II. 0.620 grm. of the same sample yielded 0.117 of water and 0.905 of carbonic acid.

III. 0.482 grm. of the same sample yielded 54 cubic centimetres of nitrogen, at the temperature of 57.2 Fahrenheit, and under an atmospheric pressure of 761 millimetres (about 29.8), the gas being saturated with moisture.

IV. 0.580 grm. of another sample yielded 0.102 of water and 0.842 of carbonic acid.

V. 0.500 grm. of the same sample as IV. yielded 57 cubic centimetres of nitrogen, at the temperature of 53.6 Fahrenheit, and under an atmospheric pressure of 758 millimetres, the gas being saturated with moisture.

VI. 0.452 grm. of a third sample yielded 0.079 of water and 0.651 of carbonic acid.

VII. 0.500 grm. of the same sample as VI. yielded 0.094 of water and 0.722 of carbonic acid.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.	IV.	V.	VI.	VII.
Carbon	39.53	39.80	..	39.60	..	39.29	39.38
Hydrogen ..	2.03	2.09	..	1.95	..	1.94	2.08
Nitrogen ...	..	..	13.22	..	13.51	—	—
Oxygen	—	—	—	—	—	—	—

And agree with the formula:—

$$C_{14}\,H_4\,N_2\,O_{12} = C_{14}\,H_4\,O_4\,2(NO_4).$$

Theoretically we have:—

C_{14}	1050	39.56
H_4	50	1.88
N_2	354	13.34
O_{12}	1200	45.22
	2654	100.00

To enable me to determine the equivalent of binitrobenzoic acid I prepared the silver salt of that acid. I proceeded by the method of double decomposition, using as agents nitrate of silver and binitrobenzoate of ammonia. I washed the precipitate formed; it appeared of a fine white colour. I dried it in vacuo, and in the dark.

0.470 grm. of substance left upon calcination 0.159 of metallic silver = 0.171 of oxide of silver; whence the atomic weight of the acid may be calculated as = 2535.3.

Another experiment gave the following results:—

0.612 grm. of the silver salt left upon calcination 0.206 of metallic silver ≙ 0.221 of oxide of silver; whence the atomic weight of the acid may be calculated as = 2565.4.

Taking the mean of these two results we obtain the number 2550.4.

Theoretical calculation leads to the number 2541.5, assuming the anhydrous acid to be represented by the formula:—

$$C_{14}\,H_3\,N_2\,O_{11}.$$

The free acid contains one equivalent of water in the place of the one equivalent of oxide of silver of the silver salt; the formula of the free acid is accordingly:—

$$C_{14}\,H_4\,N_2\,O_{12} = C_{14}\,H_3\,N_2\,O_{11} + HO.$$

The binitrobenzoic acid derives these clearly from the benzoic acid, and is formed by the substitution of two atoms of hyponitric gas for two atoms of hydrogen. We have:—

$$C_{14}\,H_6\,O_4 + 2NO_5 = 2HO + C_{14}\,H_4\,O_4\,2(NO_4).$$

With a view to control the preceding formula, and to establish it with the utmost accuracy, I prepared the ammoniacal salt and the ether of the acid, and subjected these two compounds to direct analysis by combustion with oxide of copper.

Binitrobenzoate of Ammonia is produced by dissolving binitrobenzoic acid in ammonia, and concentrating the liquid by evaporation. The new salt separates under the form of fine needles which, when dry, acquire a fine silky lustre.

This salt dissolves readily in water, particularly in boiling water.

The analysis of the binitrobenzoate of ammonia gave the following results:—

I. 0.574 grm. of substance yielded by combustion with oxide of copper 0.163 of water and 0.767 of carbonic acid.

II. 0.500 grm. of the same sample yielded 0.141 of water and 0.672 of carbonic acid.

III. 0.403 grm. of the same sample yielded 62 cubic centimetres of nitrogen, at the temperature of 48.2 Fahr., and under an atmospheric pressure of 760 millimetres, the gas being saturated with moisture.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.
Carbon	36.44	36.65	—
Hydrogen	3.15	3.13	—
Nitrogen	..	..	18.52
Oxygen	—	—	—

Theoretically we have:—

C_{14}	1050	36.68
H_7	87.5	3.06
N_3	525	18.34
O_{12}	1200	41.92
	2862.5	100.00

Binitrobenzoic Ether is readily obtained by dissolving binitrobenzoic acid to saturation in concentrated boiling alcohol; after some time an oil separates, of which the amount is then increased by adding water to the alcoholic liquid. This oil, which concretes upon cooling, is simply binitrobenzoic ether, with a slight admixture of free acid, which latter is removed by washing with ammoniacal water. The residue is then again washed in pure water, and dissolved in boiling alcohol, from which solution it separates upon cooling in the form of long, fine, and very brilliant needles, which show the slightest tinge of yellow.

The binitrobenzoic ether is rapidly decomposed by the action of a concentrated, and, more particularly, a hot and concentrated, solution of potass, and alcohol and binitrobenzoic acid are regenerated.

The analysis of the binitrobenzoic ether gave the following results:—

I. 0.425 grm. of substance yielded by combustion 0.134 of water and 0.697 of carbonic acid.

II. 0.394 grm. of the same sample yielded 0.122 of water and 0.646 of carbonic acid.

III. 0.460 grm. of the same sample yielded 46 cubic centimetres of nitrogen, at the temperature of 60.8 F., and under an atmospheric pressure of 753 millimetres, the gas being saturated with moisture.

IV. 0.500 grm. of another sample yielded 0.153 of water and 0.822 of carbonic acid.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.	IV.
Carbon	44.72	44.67	..	44.83
Hydrogen ...	3.49	3.44	..	3.39
Nitrogen	..	..	11.58	—
Oxygen	—	—	—	—

Theoretically we have:—

C_{18}	1350	45.00
H_8	100	3.33
N_2	350	11.67
O_{12}	1200	40.00
	3000	100.00

ACTION OF FUMING NITRIC ACID AND OF THE NITRO-SULPHURIC MIXTURE UPON CUMINIC ACID.

Cuminic acid dissolves in fuming nitric acid with the aid of a gentle heat; on heating the solution to boiling reddish fumes are evolved, but this phenomenon is not attended with any appa-

rent energetic action. The mixture is kept boiling for some minutes, and water is then added, whereupon a heavy yellow oil separates, which speedily concretes.

To free this product from the nitric acid which it may still retain, it is pounded, repeatedly washed with distilled water, and dissolved in alcohol, from which solution it crystallizes by spontaneous evaporation, in the form of yellowish-white scales.

This new product is insoluble in water, but dissolves readily in alcohol and in ether; it dissolves also very readily in solutions of potass, soda, and ammonia, with which three bases it forms crystallizable salts.

The analysis of this product gave the following results:—

I. 0.450 grm. of substance yielded 0.220 of water and 0.946 of carbonic acid.

II. 0.504 grm. of the same sample yielded 29 cubic centimetres of nitrogen, at the temperature of 55.4 Fahr., and under an atmospheric pressure of 758 millimetres, the gas being saturated with moisture.

III. 0.500 grm. of the same sample yielded 0.240 of water and 1.050 of carbonic acid.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.
Carbon	57.33	..	57.32
Hydrogen	5.42	..	5.33
Nitrogen	..	6.79	—
Oxygen	—	—	—

And agree with the formula:—

$C_{20}\,H_{11}\,NO_8$.

Theoretically we have:—

C_{20}	1500	57.41
H_{11}	137.5	5.26
N	175	6.69
O_8	800	30.64
	2612.5	100.00

This new substance, of which the formula may be written as follows:—

$$C_{20}\,H_{11}\,O_4\,(NO_4)$$

differs accordingly from cuminic acid simply in this, that we find in it one atom of hyponitric gas substituted for one atom of hydrogen. I propose, therefore, to call it *nitrocuminic acid*.

With a view to determine the equivalent number of the nitrocuminic acid, I prepared the silver salt of that acid by the method of double decomposition, using as agents solution of nitrate of silver and solution of the purest nitro-cuminate of ammonia. The silver salt produced is of a beautiful white colour. I dried it in vacuo.

The analysis of this salt gave the following results:—

0.500 grm. of the salt left upon calcination 0.170 grm. of metallic silver. From this I deduce 2512 as the number representing the atomic weight of the acid. Calculation, based upon the preceding formula, leads to the number 2500 for the anhydrous acid.

If, instead of using nitric acid, we use the nitro-sulphuric mixture, the result is very different. If fused cuminic acid is projected in small portions into the slightly heated nitro-sulphuric liquor, it disappears gradually without violent reaction or disengagement of gas. On heating the solution to ebullition, reddish vapours are copiously evolved, and soon after the liquid turns suddenly turbid, and deposits a great number of small and exceedingly brilliant crystalline scales. The action is now complete, for, although the deposit, indeed, disappears again upon addition of a fresh supply of nitro-sulphuric mixture, yet it reappears with all its original properties upon a somewhat prolonged ebullition.

The new product, having been freed previously by the proper washings from all traces of the acids adhering to it, is treated with boiling alcohol, which dissolves it, and deposits it again, upon cooling, in the form of lustrous plates. It is also very soluble in ether. Fuming nitric acid seems to exercise no action upon it, not even after long-continued ebullition. Caustic ammonia and concentrated solutions of potass and soda fail to dissolve it, even with the aid of heat; they seem, in fact, to exercise no action whatsoever upon it.

The analysis of this new substance gave the following results:—

I. 0.556 grm. of substance yielded 0.202 of water and 0.965 of carbonic acid.

II. 0.440 grm. of the same sample yielded 41 cubic centimetres of nitrogen, at the temperature of 62.6 Fahr., and under an atmospheric pressure of 763 millimetres, the gas being saturated with moisture.

III. 0.500 grm. of the same sample yielded 0.178 of water, and 0.865 of carbonic acid.

IV. 0.476 grm. of the same sample yielded 44 cubic centimetres of nitrogen, at the temperature of 59° Fahr., and under an atmospheric pressure of 758 millimetres, the gas being saturated with moisture.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.	IV.
Carbon	47.33	..	47.20	—
Hydrogen	4.03	..	3.96	—
Nitrogen	..	10.87	..	10.79
Oxygen	—	—	—	—

and agree with the formula:—

$C_{20}\,H_{10}\,N_2\,O_{12}$.

Theoretically we have:—

C_{20}	1500	47.25
H_{10}	125	3.93
N_2	350	11.03
O_{12}	1200	37.79
	3175	100.00

Now, this formula may be written thus:—

$$C_{20}\,H_{10}\,O_4\,2(NO_4)$$

Whence it will be seen that the new product differs from cuminic acid simply in this, that two atoms of hydrogen have been eliminated and are replaced by two atoms of hyponitric vapour. The proper designation for the new compound would accordingly be that of *binitrocuminic acid;* but it possesses no acid properties. It is, then, an isomeron of the binitrocuminic acid, with a different atomic constitution. We know, in fact, that the substitution of hyponitric gas for hydrogen in a compound gives rise to the formation of new products of increased acidity. We may instance phenic acid and picric acid. In this case, however (viz., in the case of the compound resulting from the action of the nitro-sulphuric liquor upon cuminic acid), we observe the very reverse.

ACTION OF FUMING NITRIC ACID AND OF THE NITRO-SULPHURIC LIQUOR UPON MESITYLENE.

We know that Sir Robert Kane was led, by his researches on acetone, to regard the latter substance as an alcohol susceptible to be resolved, under the influence of hygroscopic bodies, into aqueous vapour, which is absorbed by the latter, and a carburet of hydrogen which, in this series, would correspond to the olefiant gas. To this carburet of hydrogen Sir Robert has given the name of mesitylene. He says, in his treatise on the substances deriving from acetone, that, "on treating mesitylene with nitric acid, several products are obtained, among which figure mesitic-aldehyde and nitro-mesitylene, which he considers to derive from mesitylene by the substitution of nitrous gas for hydrogen.

Upon treating mesitylene with fuming nitric acid, I obtained (like Sir Robert Kane) a heavy oil of a brownish-red colour, and strong pungent smell, but presenting in other respects no definite characteristics. I obtained a very different result by the action of the nitro-sulphuric liquor upon mesitylene.

If a certain quantity of the nitro-sulphuric liquor be poured into a tumbler, and pure mesitylene be dropped into this liquid, the mixture being stirred all the while with a glass rod, a solid, white, flocculent matter will speedily separate. This matter, when collected upon the filter and dried, presents the aspect of tufts of fine crystalline needles. If the process be conducted gently and with care, there will be hardly any perceptible elevation of temperature observed.

When a sufficient quantity of the new product has been formed in the liquid water is added; the liquid is then filtered, and the solid matter collected on the filter; it is now washed with distilled water until the rinsings cease to manifest an acid reaction; the washed product is dried by compression between double folds of blotting-paper, and subsequently treated with alcohol; this agent does not dissolve it perceptibly in the cold, but removes from it a substance which imparts to it a roseate-yellow tint. The product is now colourless. It may be purified still further by sublimation at a gentle heat. Prepared in this way, the new product is obtained in the form of exceedingly fine and brilliant needles, presenting the aspect of the argentine flowers of antimony.

The new product may be obtained also in the form of clearly-defined prismatic needles, by dropping mesitylene into the nitro-sulphuric liquor, until the mixture commences to turn turbid, and then leaving the liquid at rest in a very moist atmosphere, when the new product will slowly crystallize.

The analysis of this new substance gave the following results:—

I. 0.500 grm. of substance yielded 0.155 of water and 0.778 of carbonic acid.

II. 0.540 grm. of the same sample yielded 0.170 of water and 0.837 of carbonic acid.

III. 0.416 grm. of the same product yielded 58 cubic centimetres of nitrogen, at the temperature of 55.4° Fahrenheit, and under an atmospheric pressure of 762 millimetres, the gas being saturated with moisture.

IV. 0.434 grm. of the same sample yielded 0.142 of water and 0.672 of carbonic acid.

These results, calculated in hundredths, lead to the following numbers:—

	I.	II.	III.	IV.
Carbon	42.43	42.29	..	42.26
Hydrogen	3.44	3.49	..	3.61
Nitrogen	..	..	16.55	—
Oxygen	—	—	—	—

and agree with the formula:—

$C_6\,H_3\,NO_4$.

Theoretically we have:—

C_6	450	42.35
H_3	37.5	3.53
N	175	16.47
O_4	400	37.65
	1062.5	100.00

CONCLUSIONS.

It results from the preceding researches that:—

1. The sulphuric acid never forms, either as such or in the state of sulphurous acid, a constituent part of the new compounds produced by the action of the nitro-sulphuric liquor upon certain organic substances.

2. When operating with equal quantities of fuming nitric acid and of the nitro-sulphuric liquor, and for an equal space of time, a larger proportion of nitrogen and oxygen are fixed in the new compound in the latter that in the former case.

In what manner, then, does the sulphuric acid of the nitro-sulphuric mixture act? Is it by seizing upon the water which the organic matter might retain? This assumption is combated by the fact that the phenomena are the same, whether we operate upon products of ternary composition, containing either crystallization or basic water, such as lignin, starch, sugar, dextrine, &c., or upon carburets of hydrogen, such as benzone, benzoëne, naphthalin. Is it in the state of nitric acid (NO_5), or of hyponitric acid (NO_4), that the nitrogen is fixed in the new compounds? To me it appears that the nitrogen is fixed in them invariably in the state of hyponitric acid; at all events, as regards the carburets of hydrogen, no other hypothesis could be maintained. If we act upon a carburet of hydrogen,

$C_m H_n$,

with fuming nitric acid, analysis tells us that the divers products which may result from this action are represented invariably by one of the following formulæ :—

$C_m H_n - 1, NO_4$,
$C_m H_n - 2, N_2 O_8$,
$C_m H_n - 3, N_3 O_{12}$,

&c. &c.

Now, it is evident that

Nitrobenzide, $C_{12} H_5 NO_4$,
Nitrobenzöene, $C_{14} H_7 NO_4$,
Nitronaphthalin, $C_{20} H_7 NO_4$,

cannot contain nitric acid (NO_5). We will assume, by analogy, that the same holds good for nitrobenzoic acid,

$C_{14} H_5 NO_8$,

indigotic (or nitrosalicylic) acid,

$C_{14} H_5 NO_{10}$,

and a number of other analogous compounds.

As regards the pyroxylin of Pelouze, it is possible that that curious compound contains nitric acid fixed upon the tissue in the manner of a colouring matter or of a mordant. This much is certain, that pyroxylin differs in some respects from those compounds in which we are justified to assume the fixation of NO_4.

But if, in these latter compounds, we have substitution of the atom NO_4 for the atom H, we have evidently also formation of water :—

$C_m H_n + NO_5, HO = C_m H_{n-1}, NO_4 + 2HO$.

This water, then, is added to that which the nitric acid contains already, and tends, accordingly, to weaken it. Now, may not the sulphuric acid which is added to the nitric acid in the highest state of concentration, perhaps serve to retain this water, and thus to prevent the weakening of the nitric acid, so that the portion which takes no part at the commencement of the reaction may, being guarded against hydration, react in its turn upon the first product formed, and thus give rise to the production of a new compound derived, like the first, by substitution? Perhaps, also, the nitric acid and the sulphuric acid enter into some peculiar combination of greater efficiency than the simple nitric acid possesses. The decision of these questions must be left to further researches.

The *prima causa* of these curious phenomena is evidently attributable to the combustion of a portion of the hydrogen of the organic matters by a proportional amount of oxygen supplied by the nitric acid; the latter, yielding up one atom of oxygen, is converted into the much more stable NO_4; and, as this combustion is not sufficiently energetic to upset the equilibrium of the atom, the compound NO_4 takes the place of the eliminated hydrogen; so that, although the chemical properties of the compound be modified by the substitution of NO_4 for H, the molecular arrangement rests the same.

These results are analogous to those produced by the reciprocal action of chlorine and organic substances; this action is determined by the affinity of the chlorine for hydrogen, as M. Chevreul has most clearly demonstrated in one of his essays on substitutions. The ruling phenomenon is the combustion of a portion of the hydrogen of the organic matter by an equivalent proportion of chlorine; the ensuing substitution is only a secondary phenomenon.

Be this, however, as it may, this much is certain, that the nitro-sulphuric mixture is a most valuable reagent to fix the maximum of hypronitric acid in an organic substance.

With the aid of this reagent M. Pelouze and other chemists have produced latterly some curious compounds, which when carefully studied may lead to important practical results.

ON SOME NEW APPLICATIONS OF SULPHURETTED HYDROGEN IN CHEMICAL ANALYSIS.

By M. EBELMEN.

Sulphuretted hydrogen has rarely been employed in analysis except to precipitate certain metals from their acid solutions, yet it is one of the most convenient and exact reagents known in very many other cases. It is the object of this paper to show that it may also be employed with great advantage for separating certain substances by converting them into sulphurets in the dry way. Sometimes it will happen that one of the sulphurets formed is not acted upon by acids, while the other is; at other times one of the sulphurets is volatile, and is separated by employing an elevated temperature. I have, by the use of the method about to be described, solved several problems of analysis which refused to yield to the methods at present most commonly used. I proceed to give details of the results :—

Separation of Manganese from Cobalt.—The methods which have been recommended for effecting this separation are very numerous. The best of these, according to Rose, consists in converting the two oxides into protochlorides by heating in a current of muriatic gas, and treating the protochlorides with hydrogen at a high temperature. Only the protochloride of cobalt is reduced to the metallic state, so that the protochloride of manganese is merely dissolved by water. This is a complicated and not very accurate method; some oxide of manganese is always left behind with the cobalt. It has lately been proposed to treat the solution of the two oxides in muriatic acid, with an excess of carbonate of baryta, and then to pass a current of sulphuretted hydrogen into the neutralized liquid, and the cobalt only, it was said, was precipitated in the state of sulphuret. On trying this process, I found that the cobalt was indeed precipitated before the manganese, but that the latter metal was entirely thrown down in the presence of carbonate of baryta by the sulphuretted hydrogen; therefore it is impossible to separate the two metals in this manner.

I have effected the separation in question in a very simple and expeditious manner. My method is founded on the fact that the sulphuret of cobalt prepared in the dry way is not at all acted on by cold muriatic acid, which is not true of sulphuret of manganese. I proceed as follows :—The mixture of the two oxides is first weighed, and afterwards placed in a platinum or porcelain tray, and heated in a current of sulphuretted hydrogen. The action commences at the ordinary temperature, and the mixture of the oxides gives off considerable heat in the gas. The tube containing the two oxides is then raised to a dark red heat, the sulphuret is cooled in a current of sulphuretted hydrogen, the tray drawn out of the tube and digested in cold water containing a little muriatic acid, when the sulphuret of manganese alone is found to be dissolved. The solution is filtered after having digested during some hours, the liquid boiled, precipitated with potash, and the oxide of manganese determined. The sulphuret of cobalt leaves a black residue, which is dissolved in nitric acid, and its solution precipitated by potash. The accuracy of the process may be tested by the following experiments :—

First Experiment.—A mixture of

Red oxide of manganese.. 0.300 grm.
Protoxide of cobalt ..... 0.300 "

was dissolved in muriatic acid, the whole precipitated with potash, and the precipitate collected, washed, and calcined; its weight with the ash of the filter was 0.611. It was next heated in sulphuretted hydrogen on a porcelain tray, the sulphurets were digested for twelve hours in cold hydrochloric acid greatly diluted, and then filtered. The filtered liquid was totally devoid of colour, and gave 0.302 red oxide of manganese on treatment with potash. The sulphuret of cobalt residue was decomposed with nitric acid, and the filtered solution precipitated with potash: it yielded 0.303 protoxide of cobalt. The red oxide of manganese, on examination by the blowpipe, gave a perfectly colourless bead with borax in the reducing flame, proving that no cobalt was present. The oxide of cobalt treated with nitre and potash in a silver crucible exhibited not the least sign of the presence of manganese.

Second Experiment.—A mixture of

Red oxide of manganese.. 0.481 grm.
Protoxide of cobalt ..... 0.090 "

treated as in the first experiment, gave—

Red oxide of manganese.. 0.486 grm.
Protoxide of cobalt ..... 0.092 "

Each of the oxides was found to be free from the other.

Third Experiment.—0.023 grm. of red oxide of manganese and 0.980 protoxide of cobalt were mixed, and yielded on similar treatment 0.028 oxide of manganese; the cobalt was not estimated in this case. The oxide of manganese gave a perfectly colourless bead with borax in the reducing flame. When dissolved in hydrochloric acid it furnished a colourless, transparent liquid, which gave an orange-coloured precipitate with hydrosulphate of ammonia. Any quantity of cobalt, however minute, would have blackened it.

It is noticeable that a slight excess of manganese appears in the estimates of all the experiments. This may be accounted for by the presence of a small quantity of foreign substances in the alkaline solution employed to precipitate the two metals. To obtain alkalis perfectly free from silica or alumina every analytical chemist knows is a very difficult matter. The cobalt and manganese from the preceding experiments, it was also found, always lost some slight insoluble residue when treated with muriatic acid after calcining and weighing.

Fourth Experiment.—A mixture consisting of 0.963 grm. of red oxide of manganese and 0.012 of protoxide of cobalt yielded on treatment as above 0.012 of oxide of cobalt. The manganese was not estimated. Not a trace of manganese was contained in the oxide of cobalt. It is plain from the two last experiments that this process may be used for the exact separation of cobalt and manganese, even when the quantity of one metal is much greater than that of the other. It may be applied to the immediate examination of ores of manganese for oxide of cobalt. In this case it would be sufficient to heat them in a current of sulphuretted hydrogen, and treat them with very dilute sulphuric acid. All the cobalt would reside in the insoluble residue.

Separation of Manganese and Nickel.—This object is effected by the same method as we have indicated for manganese and cobalt. A mixture of

Protoxide of nickel..... 0.179 grm.
Red oxide of manganese .. 0.321 "

was dissolved in muriatic acid, precipitated with potash, the precipitate calcined, the residue heated in sulphuretted hydrogen, and treated with cold, very weak muriatic acid. The result was

Oxide of nickel ..... 1.178 grm.
Red oxide of manganese ... 0.320 "

as exact, it will be observed, as in the case of the separation of cobalt from manganese.

Separation of Manganese and Zinc.—I have endeavoured to adapt the above process to the separation of these two metals. The sulphuret of zinc dissolves in time in dilute hydrochloric acid. I therefore treated the mixture of the two sulphurets prepared in the dry way with acetic acid, and assisted its action by heat. In this way the manganese alone is dissolved, but the sulphuret of zinc retains a small quantity of manganese which I have not been able to get rid of by this method. When operating with large quantities of zinc and manganese I have invariably obtained too much oxide of zinc, and have found it mixed with a certain amount of oxide of manganese.

Separation of Iron and Cobalt.—On heating a mixture of peroxide of iron and cobalt in sulphuretted hydrogen, and acting on it with even strong hydrochloric acid, scarcely any iron is removed; almost all the sulphuret of iron is retained by the sulphuret of cobalt. As the sulphuret of iron obtained by heating peroxide of iron almost to redness in sulphuretted hydrogen is not affected by cold weak hydrochloric acid, it occurred to me that this property might be employed for separating iron and manganese, but I have found, by repeated experiments, that

the sulphuret of iron always contains a large proportion of sulphuret of manganese. Certain sulphurets offer a means of separation in their volatility. Two of these I will describe, one relating to the separation of arsenic and iron, the other to the separation of arsenic and tin.

Separation of Iron and Arsenic.—When arseniate of iron is heated in a current of sulphuretted hydrogen, the iron and arsenic are both completely sulphurized, but the arsenic is wholly volatilized.

The separation is effected with great exactness. I made a mixture of

Metallic iron 1.330 grm., corresponding to peroxide	1.900
Arsenious acid 1.380 grm., corresponding to arsenic acid	1.711
	3.611

These two bodies were dissolved in aqua regia, and the solution precipitated with ammonia in excess. The precipitate was dried, and cautiously removed from the filter: after calcination it weighed 3.315. The filter and substances adhering were separately calcined in a porcelain crucible, and yielded 0.055=3.370, a number much lower than what ought to have been obtained if the whole of the arsenic had been precipitated with the peroxide of iron. A very large quantity of arsenic was found remaining in the solution of ammonia, but no iron whatever. This amounted to 0.241 grm., *i.e.*, 14 per cent. of the total quantity. Therefore 3.370 arseniate of iron must contain :—

Peroxide of iron .	1.900 grm.	56.4 in 100 parts.
Arsenic acid....	1.470 "	43.6 "
	3.370	100.0

A composition approaching very nearly the formula $As\ O_5$, $2Fe_2\ O_3$. 0.788 grm. of this arseniate, was heated to a nascent red heat in sulphuretted hydrogen, by which a large quantity of sulphuret of arsenic was volatilized. The remaining sulphuret of hydrogen was of a greenish-yellow colour, possessing also a metallic lustre: its weight was 0.6065 grm. It was dissolved in nitro-muriatic acid, precipitated with ammonia, and gave 0.44 peroxide of iron. The arseniate must thus have contained :—

Peroxide of iron..	0.444 grm.	56.3 per cent.
Arsenic acid (from the loss)	0.344 "	43.7 "
	0.788	

The peroxide was now dissolved in muriatic acid. The solution when boiled with sulphurous acid and treated with sulphuretted hydrogen showed no trace of sulphuret of arsenic.

In the

Second Experiment 1.050 grm. of the same arseniate of iron gave, after the above-described treatment:—

Peroxide of iron	0.594 grm.	56.5 per cent.
Arsenic acid	0.456 "	43.5 "

The peroxide of iron yielded not a trace of arsenic.

These two experiments, from the close agreement of these results, and with the results synthetically deduced, must be considered to establish the accuracy of the method. The native arseniates of iron may be directly analyzed by this method, and it may, perhaps, be also applied without modification to the immediate analysis of arseniates of cobalt, nickel, zinc, copper, and lead. If a current of sulphuretted hydrogen is made to pass over heated perphosphate of iron the latter is merely converted into the protophosphate; this dissolves in muriatic acid, leaving no residue, and no sulphuretted hydrogen is disengaged.

One of the most difficult problems in analytical chemistry is the

Separation of Arsenic and Tin.—Professor Rose, in his work on "Chemical Analysis," admits that he is not acquainted with any good method of separating these two bodies. I have applied the method just described to the separation of arsenic and tin, and find that the process admits of very great accuracy. 0.495 grm. of fine tin, corresponding to 0.629 of stannic acid, and 0.233 of arsenious acid, were weighed off, the two substances treated with hot nitric acid, evaporated nearly to dryness, and mixed with water. After calcination the oxide of tin weighed 0.746; it contained, therefore, 0.117 of arsenic acid, or 15.7 per cent. of its weight; the rest of the arsenic had remained in solution. From this 0.746 grm. of arseniate of the oxide of tin I took 0.347, and heated it upon a porcelain tray in a current of sulphuretted hydrogen. A great proportion of the sulphuret of arsenic sublimed; the remainder was most probably a compound of bisulphuret of tin and a lower sulphuret. This residue was roasted and then strongly calcined in a platinum crucible; it left 0.286 stannic acid, or 82.4 per cent. According to synthesis 84.3 ought to have been formed, but I explain this difference by the difficulty of obtaining perfectly pure tin. I ascertained in the most satisfactory manner, by reducing the 0.286 stannic acid and treating the tin with hydrochloric acid, that the sulphuret of tin retained not a trace of arsenic. I did not determine the arsenic, though this would have been easy, since all the sulphuret of arsenic was contained either in the dipping-tube or in the water into which it is dipped. It appears probable that this method may be applied to the direct analysis of the arseniuret of tin, as well as to that of the arseniates of that metal.—*Ann. de Chim. et de Phys.*, Jan. 3, 1849.

ON SOME BINARY COMPOUNDS FORMED BY THE METALLOIDS, AND MORE ESPECIALLY BY THE ACTION OF PERCHLORIDE OF PHOSPHORUS ON SEVERAL ACIDS.

By M. PERSON.

It would appear, *à priori*, from the high degree in which phosphorus is susceptible of oxidation, that on bringing the perchloride of phosphorus, or the protochloride, into contact with strong nitric acid, or with nitrates, the phosphorus would be oxidized at the cost of the oxygen of the nitric acid, and that the resulting chlorine in the presence of nitrogen, like itself in a nascent state, would be in the best condition for uniting with the nitrogen to form perchloride of nitrogen. With that expectation I made the experiment with concentrated nitric acid and perchloride of phosphorus in a tube sealed before the lamp; but I found that the reaction was by no means so direct and easy as I had imagined. That the phosphorus was oxidized, and phosphoric acid formed, is indisputable; but the chlorinated compound, which it was supposed would consist simply of chlorine and nitrogen, always contained a certain amount of oxygen, and is analogous, perhaps even identical, with the products of aqua regia recently examined by M. Gay-Lussac under certain conditions.

Nitrous acid furnishes anhydrous phosphoric acid and a complex chloronitrous compound in contact with the perchloride of phosphorus. Nitric acid and also nitrous acids placed in contact with the protochloride of phosphorus act very energetically, and the reaction is accompanied by a loud explosion. In order to ascertain the capacity of the perchloride of phosphorus of reducing certain oxidized compounds I made it act upon sulphuric, sulphurous, and phosphoric acids. Instead of the double displacement of the elements which I had expected I obtained a simple combination of the binary compounds. Thus, when the perchloride is made to act indirectly upon the sulphuric acid by passing the chloride into persulphate of mercury, suitably heated in a glass tube, a compound is obtained represented by $Cl_{10}\ P_2 + SO_3$; but, when the chloride is transmitted directly into anhydrous sulphuric acid, a compound is obtained represented by $Cl_{10}\ P_2 + 2SO_2$. These compounds are liquid at ordinary, and volatilized at high, temperatures. They are decomposed by water into sulphuric, phosphoric, and muriatic acids. When pure dry sulphurous gas is passed into the lower portion of a retort containing perchloride of phosphorus, and furnished with a receiver, the two substances disappear and give rise to a white liquid which volatilizes without decomposing, and which in its pure state may be represented as $Cl_{10}\ P_2 + SO_2$. In contact with water, this compound at first furnishes substances such as would be immediately produced by the action of the agent upon perchloride of phosphorus, viz., hydrochloric and phosphoric acids, then sulphurous acid; for the new substance on decomposition with water a liquid is obtained possessing all the properties of a solution of sulphurous acid. This liquid reduces the manganates, the chromates, the iodates, and it does not precipitate an acid solution of chloride of barium; but when previously treated with chlorine it yields an abundant precipitate.

If the vapour of perchloride of phosphorus is passed over a layer of anhydrous phosphoric acid, the two combine to form a colourless liquid compound, whose boiling point is fixed, and which is decomposed by water into hydrochloric and phosphoric acids. I made an analysis of a portion of this compound, from which I am led to express its constitution by the formula $Cl_{10}\ P_2 + P_2\ O_5$. By substituting other chlorides for the perchloride of phosphorus, and the above anhydrous oxyacids by other oxygenous and non-oxygenous compounds, likewise anhydrous, and acting the same part, I have obtained several other compounds of the same kind. All my investigations induce me to believe that we are on the point of discovering a number of combinations of the second order formed by binary compounds. It is probable that Kuhlmann's crystalline compound, obtained by acting upon the perchloride of tin with nitric oxide, is only one of such compounds.—*Comptes Rendus*, Jan. 15, 1849.

A NEW TEST FOR THE PROTEINE COMPOUNDS.

By M. E. MILLON.

A very acid liquid is obtained by dissolving mercury in its own weight of nitric acid with $4\frac{1}{2}$ equivalents of water. This is a very delicate reagent for every albuminous substance, and for very many of the secondary products allied to them. It communicates to such substances a very deep blood-red colour, by the aid of which one hundred thousandth part, and even a smaller quantity, of albumen may be detected in water.

As conveying some idea of the nicety of this test, and of its eligibility for estimating the nature of vegetable productions, I may state that cotton, starch, and gum arabic assume a very decided rose colour in its presence. Nearly all urines become red upon the addition of the nitro-mercurial mixture when heat has been applied to destroy the gelatine. The albumen of blood and of vegetables, fibrine, caseine, gluten, legumine, silk, wool, feathers, horn, epidermis, gelatine, chondrine, proteine, the buffy coat of the blood, when well washed, as well the insoluble portion as the soluble product, from which it is separated by boiling water, are all coloured, more or less, deep red. When proteine is rendered soluble by the continued action of alkaline solutions, or of sulphuric acid, the red colour is always produced; but the substance obtained is no longer soluble, and the liquid becomes deep red without giving any precipitate.

Xanthoproteic acid, the chlorites, and the oxides of protcine derived from the chlorites, differ from the above-mentioned products, as they are not coloured red in the least; the buffy coat of the blood cannot, therefore, be identical with the proteine oxides obtained by acting on chlorites of proteine with potash. Some very interesting peculiarities may be demonstrated by this reagent. I have already satisfied myself of the existence of no less than three distinct substances furnished by the action of chlorine on albumen until the gas ceases to be absorbed.

The reagent is prepared by pouring an equal weight of nitric acid with $4\frac{1}{2}$ equivs. of water upon pure mercury. This is followed by a very

energetic reaction; when it subsides a gentle heat is applied until the whole of the metal is dissolved. Two volumes of water are then added for one of the mercurial solution. When this has stood some hours the liquid above the crystalline mixture of protonitrate and protonitrite of mercury is decanted. This liquid reacts upon the albuminous substances in the cold, but perfectly only at a temperature at least 140°; indeed the best plan is to boil the mixture in the first instance. The red substance is not affected by prolonged contact with an excess of the reagent. I have kept albumen of a deep red colour for more than a year in a large excess of the mercurial liquid. The specific property of the reagent, it should be noticed, resides not in the protonitrate or in the pernitrate of mercury, nor in a mixture of both: the solution containing the two salts must also contain nitrous acid, or no colouring can be produced. A tolerably distinct reaction is observable with the pure pernitrate of mercury, saturated with nitrous acid, but this is not comparable with that of a mixture of the two salts saturated with nitrous acid. It will, therefore, be advisable to adhere to the directions above given in the preparation of the agent.—*Comptes Rendus*, Jan. 8.

ON THE METAMORPHOSIS OF MALIC ACID WITH SUCCINIC ACID.

By M. DESSAIGNES.

M. Piria has shown that asparagine may be regarded as the amide of malic acid. Impure, and dissolved in water, it speedily ferments, and becomes converted into succinate of ammonia. It appeared to me that if malic acid, or one of its salts, could experience fermentation of the same kind, a more satisfactory proof of the relations of asparagine and malic acid, predicted by M. Piria, would be furnished. I obtained neutral malate of lime by Liebig's process from the berries of the mountain ash, and left it under a rather high column of water, in a vessel covered merely with paper, in the autumn of 1847. In about three months the water became filled with a mucilaginous organized product, in which and upon the sides of the vessel a great number of very beautiful crystals of hydrated carbonate of lime were visible. The filtered water yielded a slight precipitate with acetate of lead. The mucilage and carbonate of lime ceased to form, and during the spring and summer of 1848, as the temperature rose, I perceived above the malate of lime, which was visibly decreasing, a layer of very fine clustered crystals. This layer was heaved up by some large bubbles of gas disengaged from the malate of lime. I dissolved these crystals in hot water, precipitated with carbonate of soda, and filtered, and obtained a slightly coloured solution which threw down acetate of lead, nitrate of silver, neutral perchloride of iron, and the chloride of barium when mixed with ammonia and alcohol. This liquid, when concentrated, treated with hydrochloric acid, slightly in excess, evaporated to dryness, and the residue frequently exhausted with boiling ether, yielded a solution which on spontaneous evaporation left beautiful transparent prisms of a volatile acid, which when ignited burned with flame, and left no residue on the platinum blade. This was succinic acid. The silver salt was well washed and dried at 212°; it furnished by calculation 64.80 per cent. of silver, theory requiring 65.6 per cent. The acid, purified by solution in water, and dried at 212°, gave, on combustion with oxide of copper,

	Found.		Calculated.
Carbon	40.88	...	40.68
Hydrogen	5.25	5.23	5.08
Oxygen	..	..	54.24

The succinic acid includes a considerable part of the weight of the malate of lime which has undergone fermentation. I trust I may soon be able to determine that quantity.

Asparagine would appear to exist in the buds and young shoots of all the plants included in the large family of the Leguminosæ. I have found it in all the seeds of plants of this family with which I am acquainted — broad beans, French beans, lentils, peas, clover, lucerne, sainfoin, and cytisus laburnum.

What is the common principle contained in these seeds, which in the act of germination is metamorphosed into asparagine? Is it legumine? I hope to be able to reply to this question in the spring of this year.—*Comptes Rendus*, Jan. 2, 1849.

HYPOCHLOROUS ACID AND THE CHLORIDES OF SULPHUR.

By M. E. MILLON.

Chlorine-water, when kept in flasks screened from light, undergoes no perceptible change; but when exposed to the direct solar rays its properties are found to experience considerable change. The chloride of lead is found to be converted into brown oxide, and the chloride of manganese yields a black precipitate of peroxide, whereas fresh chlorine-water exerts no action on these two chlorides.

Having examined the conditions of this reaction, to ascertain to what compound of chlorine the oxidation was to be attributed, I found that it exclusively belonged to hypochlorous acid, ClO.

It must, therefore, be easy to detect this compound, even in the midst of a solution of chlorine, when its quantity is very small, since the two tests, especially that of manganese, are very delicate. There is no reason for supposing that this action of chlorine on water is at all different from that which it exerts on most substances containing hydrogen; it takes the place of the hydrogen of the water, and the progress of this action is only arrested because the hydrochloric acid in its turn destroys the hypochlorous acid and regenerates chlorine:—

$$2Cl + HO = ClO + HCl.$$
$$ClO + HCl = 2Cl + HO.$$

The two acids, hydrochloric and hypochlorous, can exist only when a large quantity of water is present. In my opinion the very simple view of the relation which we recognise between hypochlorous acid and water should include also the chloride of sulphur, which, in this system, represents also sulphuretted hydrogen, in which hydrogen has been replaced by chlorine, equivalent for equivalent. In this arrangement the highest chloride of sulphur should contain chlorine and sulphur in equal equivalents. That more than one equivalent of chlorine cannot be combined with one equivalent of sulphur is well known, whilst, on the other hand, to unite several equivalents of sulphur with one of chlorine is an easy matter; we have thus a series which corresponds with the polysulphurets of hydrogen:—

HO HS HSn.
ClO ClS ClSn.

Comptes Rendus, Jan. 8, 1849.

ON THE ACTION OF CHLOROFORM ON THE SENSITIVE PLANT (*MIMOSA PUDICA*).

By Professor MARCET, of Geneva.*

When one or two drops of pure chloroform are placed on the top of the common petiole of a leaf of the sensitive plant, this petiole is seen almost immediately to droop, and an instant after the folioles close successively pair by pair, beginning with those which are situated at the extremity of each branch.† At the end of one or two minutes, sometimes more, according as the plant is more or less sensitive, most of the leaves next to the chloroformed leaf, and situated beneath it on the same stalk, droop one after another, and their folioles contract, although generally in a less complete manner than those of the leaf placed in immediate contact with the chloroform. After a rather long time, varying according to the vigour of the plant, the leaves open again by degrees; but, on trying to irritate them by the touch, it is seen that they have become nearly insensible to this kind of excitement, and no longer close as before. They thus remain as if torpid for some time, and generally do not recover their primitive sensitiveness till after some hours. If, however, when they are in this state of apparent torpidity, they are subjected again to the action of the chloroform, they close as they did the first time. It is not till after they have been chloroformed several times that they lose all kind of sensitiveness, at least until the next day; sometimes they even fade completely at the end of too frequent repetitions of the experiment. In all cases the effects observed are the more marked in proportion to the purity of the chloroform employed and the degree of sensitiveness in the plant.

An analogous phenomenon is produced if, instead of placing the drop of chloroform on the base of the petiole, it is laid on the folioles situated at the extremity of a branch. The folioles of this branch immediately begin to close pair by pair, the common petiole droops, lastly the folioles of the other branches close in turn. At the end of two or three minutes, the nearest opposite leaf, and, if the plant is vigorous, most of the other leaves situated below on the same stalk, follow their example. When, after some time, the leaves open again, the same want of sensitiveness is manifested as in the preceding case.

A singular feature in this phenomenon is the manner in which the action of the chloroform is propagated from one branch to another, then from one leaf to another, even when the liquid disappears by evaporation, almost as soon as it is deposited. This action, as we have just seen, appears to be communicated from the leaf to the stalk, following in the latter a descending direction; generally the leaves situated beneath the chloroformed leaf are not at all affected. De Candolle, in making an analogous experiment on a sensitive plant with a drop of nitric or sulphuric acid, remarked, on the contrary, that it was the leaves above the leaf touched which closed, without those situated beneath participating in this motion. The observation of our learned countryman is quite naturally explained by attributing to the ascending sap the transport of the corrosive poison, a transport which, in this case, would take place in the direction from below upwards. But how to account for the apparent transmission of the effects of the chloroform in the contrary direction, from above downwards? Might the descending sap more peculiarly have the property of transmitting the narcotic effects of this singular compound from one part of the sensitive plant to the other; or might there exist in this plant some special organ susceptible of being affected by certain vegetable poisons in a manner analogous to the nervous system of animals? Notwithstanding the interesting investigations of Dutrochet and other physiologists, there still prevails too much obscurity on this subject to hazard an opinion. But in any case the fact is singular, and appears to me to merit the attention of persons accustomed to engage in questions of this nature.

Experiments of the same kind, made on the contractility of the sensitive plant with rectified ether, have furnished me with results nearly similar to the preceding; with this difference, however, that, whilst one drop of chloroform placed on the common petiole of a leaf situated at the extremity of a branch of a sensitive plant suffices to cause most of the other leaves situated beneath on the same branch to close, ether in general produces an effect only on the leaf itself with which it is put in contact. The next leaves have generally appeared to me not affected. I must, however, add, that my experiments with ether having been made after the others, and at a time of year when the sensitiveness of the plant

* Read before the Société de Physique et d'Histoire Naturelle, October 19, 1848, and communicated by the author to the "Philosophical Magazine."

† I previously convinced myself by experiment that a drop of water placed delicately on a leaf of the sensitive plant caused no movement.

already began to diminish, it is possible that the intensity of the effects produced may have thereby been affected.

THE CHEMICAL TIMES.

SATURDAY, FEBRUARY 24, 1849.

ON THE PRINCIPLES OF A BILL FOR REGULATING THE PRACTICE OF PHYSIC AND SURGERY.

As the time draws near when we may expect to see some measure of medical reform passed through the Legislature, and as such measure will most likely be founded on the "Principles of a Bill for Regulating the Practice of Physic and Surgery," which were drawn up last year by the Colleges of Physicians and Surgeons, the Apothecaries' Society, and the Institute of General Practitioners, we deem it our duty to offer a few observations on these "principles," to which, in our humble opinion, the Apothecaries' Society and the Institute of General Practitioners should never have given their assent.

We object *in limine* to the spirit of the intended regulations, because, instead of tending to lead to some sort of fusion and amalgamation of the profession, they will inevitably lead to the creation of a new element of distinctness. Not satisfied with a College of Physicians, one of Surgeons, and one (except in name) of Apothecaries, we are now going to add a fourth college or institution—one of General Practitioners. The respective members of these several institutions profess, it should be observed, *all* the same art, the *ars medica*, with this exception, perhaps, that the "pure physicians" are *held* to confine themselves strictly to *internal*, the "pure surgeons" strictly to *external*, cases; whereas the "apothecaries and the general practitioners" extend the range of their attention and labour over the whole field of morbid affections. It would appear, then, at first sight that the latter, combining, as it were, in one and the same person the attributes and duties of the two former, should be held at all events equal in rank (if not superior) to them. But such is by no means the case now; on the contrary, the general practitioners are looked down upon by the members of the two colleges as vastly inferior to them in acquirements and position; and the "principles" upon which the medical reform measure is to be founded tend to perpetuate this *artificial* superiority of the one, inferiority of the other, party, to the great and serious detriment not only of the *true* interests of the profession, but also of those of the public. No one in his senses will venture to deny that the public interest demands the appointment of the most able practitioners to the *most responsible* offices of hospital or dispensary physicians. Now, in these "principles" we find that penalties are to be imposed "on all persons assuming any professional name or designation to which they are not in law entitled." This clause, as our contemporary the *Daily News* (*vide* the number of Wednesday, 21st instant, which contains a most excellent article upon the subject) very justly observes, will, though perhaps not in law, yet in fact, prevent any of the members of the projected new College of General Practitioners from holding the said office of physician to a dispensary or hospital—with what advantage or disadvantage to the public can be readily guessed from the by no means infrequent occurrence of the induction of some rather *youthful* member of the College of Physicians, whose licence must be presumed to stand him *in lieu* of long experience and practical skill.

We gather also from these "principles" that the College of Physicians, whilst willing to assent to every measure calculated to ensure the efficiency and permanency of the new College of General Practitioners, insists upon "reserving its own rights as respects the title of doctor of medicine." This, in conjunction with the fact that the registration fee is proposed to be *five* pounds in the case of a physician or fellow of the College of Surgeons, and *two* pounds only in that of a general practitioner, is a pretty strong indication of the determination of the two colleges to maintain their (self-arrogated) artificial superiority over the general practitioners.

With regard to this same title of doctor of medicine, which seems to be so highly prized by the College of Physicians, we may, perhaps, be excused if we remind that learned body that the degree of M.D. was procurable, up to within a very recent period, at many of the German universities for *money*. The Dean and Faculty of the University of Giessen, and of some other universities, have now, indeed, set their faces against this disgraceful traffic; yet, if we do not greatly mistake, the faculty of Erlangen continue even now to grant the degree of M.D. to any one who chooses to forward certain certificates (which may be readily procured or fabricated, no inquiry being likely to be instituted into the genuineness of the article), accompanied—and this is the principal, the *indispensable*, condition—by a certain sum of money for fees, &c.

The Prussian universities never practised this most disgraceful system, although in Prussia the degree and title of "doctor utriusque medicinæ" is held rather more cheaply than elsewhere, conferring upon the lucky recipient or possessor no right or privilege whatsoever, except, perhaps, to append the magical letters M.D. to his name. The Prussian laws strictly and rigorously prohibit the mere M.D. to exercise the *ars medica* anywhere within the boundaries of the Prussian dominions. To obtain the right of practice, the M.D. has to pass through a much more severe ordeal than the university examination, though the latter is severe enough in all conscience, and such as the London College of Physicians would hardly ever dream of adopting. He has to pass what is called the "*Staats-Examen*," which lasts for six or eight weeks, and is conducted at the bed of the patient, *to test the practical skill* of the candidate. If he *fail here*, the degree of M.D. will avail him nought; and though he may speak Greek and Latin like Demosthenes and Cicero; though Hippocrates, Galenus, and Celsus be familiar to him as his household gods; though he have dived deep into Avicenna and Rhazes; though he be equally acquainted with the systems of all schools, from Paracelsus and Van Helmont up to Broussais; though he know Hufeland's *Encheiridion medicum* by heart—he will not be permitted to practise any where in Prussia, and will accordingly in that respect rank considerably below the Praktische Arzt or Wundarzt of the first, nay, even of the second, class, *i.e.*, the very men who, here in England, are made to occupy the lowest position in the profession—not by the *truly* discerning public indeed, but by the two Colleges of Physicians and Surgeons.

If it might not be deemed invidious we would venture to ask which of the two publics is the better secured against the advent of "incapacities" to the right of medical practice—the English or the Prussian?

THE CHOLERA.

CASES REPORTED UP TO WEDNESDAY.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
FRESH CASES REPORTED ON FEB. 20, 1849 :—				
In London and vicinity, viz. :—				
Bethnal-green Lunatic Asylum	5	1		
Refuge, Hackney-road	21	7		
Kingsland-road	1	1		
Stoke Newington	1	1		
In the country, viz. :—				
Barking, Essex	2	1		
In Scotland, viz. :—				
Edinburgh	1	..	1	
Glasgow	13	7	4	
Newton, Dalkeith	1	1	1	
Riccarton	7	..	5	
Stow	3	1		
Mauchline	5	1	4	
Galston	3	3	1	
Galashiels	2	3		
Total new cases	65	27	16	
In London and vicinity	1038	549	135	354
In the country	940	398	151	391
In Scotland	10517	4596	3502	2419
Total	12495	5543	3788	3164

BILLS OF MORTALITY.

By the return of the registrar-general, for the week ending Feb. 17, it appears that the numbers were: births, 1,497; deaths, 1,225. The present return is of an unfavourable character. It shows that 1,225 deaths were registered in the week, while the average is 1,169. The increase is still the effect of epidemics, to which 333 deaths are ascribed, or 112 more than have occurred on the average at this season. Amongst these, scarlatina and hooping cough (which have doubled the weekly mortality from these causes of previous years), diarrhœa and cholera, are observed to predominate. The mortality from cholera and typhus was last week the same, namely, 49 deaths—the latter disease having declined to near the average. A considerable decrease continues to be observed of deaths from consumption; they were 124, or 24 less than the average. Inflammation of the lungs is also less than the average, while bronchitis is considerably above it, though the two diseases usually rise and fall together. From bronchitis the deaths were 103, the average being 78; from pneumonia there were 93, though 103 is the average. Some of

the above facts have probably an intimate connection with the unusual state of the atmosphere. The reading of the barometer was every day above 30 in. Of mean daily readings, the highest (which was on Sunday) was 30.695; the mean of the week was 30.492. At 9h. p.m. on Sunday the reading was 30.715, which continued till Monday at 2h. a.m. The highest temperature was 57.8, on Thursday; the mean of the week was 40.7.

KENSINGTON; Town.—At Jenning's-buildings, a labourer, 62, "cholera (36 hours);" at same buildings, wife of a labourer, 55, "cholera (24 hours)."

ST. PANCRAS; Gray's-inn-lane.—In Royal Free Hospital, labourer from Staffordshire, 60, "Asiatic cholera"—inquest. In same hospital, one of the children from the Holborn union, brought from Drouet's school at Tooting, M. 9, "Asiatic cholera"—inquest. In same hospital, one of the children from the Holborn union, brought from Drouet's school at Tooting, F. 6, "Asiatic cholera"—inquest. Mr. Worrell, the registrar, states that "the labourer was brought from the House of Refuge for the Destitute in Playhouse-yard, and died soon after his arrival at the hospital. He was not known to anybody."

HACKNEY; Hackney.—M. 10, "(spasmodic cholera (18 hours);" F. 82, "cholera spasmodica."

SHOREDITCH; St. Leonard's.—On 15th of February, at No. 10, Union-buildings, F. 65, "Asiatic cholera (5 days)." The certificate of Mr. Wildbore, the medical attendant, states that "she was broken up by age and troubles, was badly fed, and slept in a close and unhealthy apartment." Mr. Burchell also states that "he attended a man (husband to the above) at 10, Union-buildings, who died after 4 days' illness, on the 9th instant, of severe diarrhœa and cramp, &c.; that from the absence of one or two important symptoms he did not consider the case as true Asiatic cholera. Very bad drainage and a filthy cesspool at the back of the house probably had much to do in exciting the attack." The two following cases occurred in the Female Refuge for the Destitute:—F. 19, "diarrhœa (48 hours); cholera (24 hours);" F. 17, "cholera (14 hours)." Mr. Yarrow, the registrar, states that "the last two deaths occurred near the rear of the building. The whole of the houses in that locality are badly drained, and the cesspools overflow. The girls had, at a former time, led irregular lives, but had been inmates of the institution, the former for nearly five months, and the latter for more than a year. He believes from what he had seen during frequent visits to the place that every attention had been paid to cleanliness, diet, and other comforts."

BETHNAL-GREEN; the Green.—M. 38, "Asiatic cholera (6 days)." Church.—M. 5, "epidemic cholera (18 hours);" F. 55, "cholera Asiatica (18 hours)." Town.—At 3, Little Anchor-street, Church-street, a labourer, 40, "Asiatic cholera, 9½ hours after he was seen by the medical attendant in the last stage of collapse." Mr. Fox, medical attendant, adds, "that when he first saw him, at one o'clock in the afternoon of the 13th instant, he was in the last stage of collapse, and that he died about half-past ten at night. He was told that deceased had been in this state since an early hour of the morning, and without medical advice, and that he was attacked with the disease on the 10th instant whilst employed as a labourer in the wood-yard at the London-docks." — *Mr. Gregory's Note.* Hackney-road.—At No. 7, Victoria-place, M., hawker of poultry, 35, "malignant cholera (12 hours)." A person in comfortable circumstances. The death occurred in the same house where there were two registered last week in a low neighbourhod. At 9, Collingwood-street, near Shoreditch Church, a nurse child, daughter of a servant, 1, "malignant cholera (16 hours)." The neighbourhood is low and crowded. At 3, Coal Harbour-street, Hackney-road, son of a cabinetmaker, 7, "malignant cholera (44 hours)." At 1, Charlotte-court, Turville-street, son of a weaver, 16, "malignant cholera (17 hours)." In destitute circumstances, and in a very close crowded court. He had been at a Sunday school anniversary, and after tea had partaken plentifully of oranges. Immediately after his return he was attacked with premonitory symptoms. At 25, Coal Harbour-street, Bethnal-green, a hawker of public-house glasses, 44, "Asiatic cholera (45 hours)." His daughter stated that he had been in very indigent circumstances, and that his strength was very much reduced in consequence.

WHITECHAPEL; Mile-end New-town.—M. 6, "cholera (12 hours)." Church.—In London Hospital, M. 31, "Asiatic cholera (14 hours)."

ST. GEORGE IN THE EAST; St. Paul.—M. 58, "diarrhœa (4 days);" cholera Asiatica (51 hours)." St. John.—On the 13th Dec., at St. George's workhouse, a labourer, 19, "natural death, sudden from cholera (24 hours)," p.m., inquest. At St. George's Workhouse, widow of a mariner, 43, "natural death, sudden from cholera (6 hours)," inquest. She had been removed into the house very ill only about 7 hours before death. Mariner, 19, "sudden death from cholera (24 hours)," inquest.

STEPNEY; Shadwell and Wapping.—M. 22, "malignant cholera (21 hours);" F. 24, a single woman (no business), "natural death, sudden from Asiatic cholera (3 days)," inquest.

POPLAR; Poplar.—M. 48, "Asiatic cholera (7 hours), premonitory symptoms (2 days)." Bow and Bromley.—F. 56, "cholera (12 hours)." Had been excessively addicted to drinking. In Frederick-street, F. 21, "Asiatic cholera (23 hours)." She was an Irishwoman employed in the market gardens. Frederick-street has been often reported as in a most filthy condition, and here most of the cholera cases have occurred. At Grove-hall Asylum, Bow, M. 32, "cholera (36 hours)." At same asylum, M. 17, "cholera (12 hours)."

ST. SAVIOUR; Christchurch. — On 17th February, at St. Saviour's Workhouse, wife of a lighterman, 48, "fever (1 month), diarrhœa (3 days), cholera (30 hours)."

BERMONDSEY; Leather Market. — F. 29, "diarrhœa (2 days), Asiatic cholera (24 hours), low fever (4 days)." St. James.—F. 33, "diarrhœa (1 week), Asiatic cholera (26 hours);" F. 2, "diarrhœa (2 weeks), Asiatic cholera (2 days)."

ST. GEORGE, SOUTHWARK; Kent-road.—At 1, Cornbury-street, a policeman, 47, "Asiatic cholera (10 hours)." Borough-road.—M. 65, "malignant cholera (24 hours)."

NEWINGTON; St. Mary.—M. 33, "cholera (2 days."

CAMBERWELL; Camberwell.—At 1, Clavenden-street, widow of an engineer, 58, "cholera (12 hours)."

ROTHERHITHE; Rotherhithe.—M. 3, "cholera (22 hours);" M. 18 months, "cholera (24 hours."

GREENWICH; St. Nicholas, Deptford.—M. 26, "Asiatic cholera." He was a seaman on board her Majesty's ship Adventure, lying off Deptford. West.—The following cases occurred in the Dreadnought Hospital:—M. 19, "cholera (4 days)," p.m.; M. 23, "ulcerated leg, erysipelas, cholera (5 days)," p.m.; M. 23, "fever (1 week), cholera (5 days)," p.m.; M. 21, "cholera (6 days)," p.m.; M. 17, "cholera (4 days)," p.m.

WANDSWORTH AND CLAPHAM; Battersea.—M. 32, "cholera (3 days), low fever (2 days)." In the sub-district of Streatham and Tooting Graveney, and at Mr. Drouet's establishment, a young man, aged 16, died of "fever and pneumonia" after an illness of 16 days, and a boy, aged 5, died of "chronic mesenteritis and atrophy," after an illness of 12 weeks.

CHOLERA.—Much alarm and anxiety have been caused within these few days past amongst the inhabitants of the Hackney-road and that vicinity by a rumour, which has since turned out not to be without foundation, that the cholera had suddenly developed itself in a malignant and surprisingly fatal form in a public institution of some magnitude in the first-named thoroughfare. The building referred to is the female establishment of the Refuge for the Destitute, and the facts, as obtained by the reporter from trustworthy sources, including one of the registrars for the district, are of a somewhat remarkable nature. The institution in question, which is appropriated to the reception of women and girls whose former course of life had been of an immoral or improper character, but of whose future amendment sufficient guarantees had been afforded, is a large brick-built erection at the corner of Thomas-street, in the Hackney-road, embracing a frontage of considerable extent, and running back, including the grounds, for a distance apparently of several hundred yards. The number of inmates so accommodated is variously stated at from sixty to eighty, and it appears that up to the 14th of this month only two deaths had been returned from the establishment for a period of many years; the wards and rooms are represented as all being spacious, cleanly, and well ventilated; the food and clothing of the best description supplied to such institutions; and all the inmates in apparently the rudest health, until the day just mentioned, when two of the young women, seventeen and nineteen years of age, were suddenly attacked by the disease, and after the lapse of fourteen hours, during the greater part of which one of them was perfectly senseless, both expired in such a condition as to justify its designation as Asiatic cholera. These deaths were registered at about three o'clock on Saturday afternoon, and the corpses were buried at Hoxton at four o'clock, followed to the grave, amongst others, by one of the matrons, a fine healthy woman named Tew, forty years of age, and who had been in the establishment several years. Mrs. Tew, who seems to have been much respected by all over whom she was placed, after performing the disagreeable duty just indicated, returned to the Refuge, shortly after complained of severe illness, rapidly got worse, and was a corpse before two o'clock the same night. These deaths, in the few days which have subsequently elapsed, were succeeded by three others in rapid succession, all attributed to the same disease, of girls aged fourteen, sixteen, and seventeen respectively; and notice had scarcely been given to the registrar of this number, when it was augmented on Tuesday night by the death of a seventh, between five and six o'clock; and an eighth, whose state was so precarious that she had more than once been thought dead by the nurse, expired in the course of Wednesday morning, her death being speedily followed by that of a ninth inmate, a woman named Wilson, thirty-five years of age, who had been engaged in the capacity of temporary matron, and had only been three or four days in the asylum. The number now reported upon the "sick list" for this disorder is eleven or twelve, making twenty in all so affected, but it is gratifying to add that those persons are stated to be going on favourably; and it is but justice to the managers of the institution to mention that ample medical attendance of the first description was obtained as soon as possible to check the progress of the disease, that their efforts are considered to have been so far successful, and that the closest attention is paid to the sick inmates by the additional nurses since hired; in addition to which several noblemen and gentlemen, members of the managing committee, were in attendance on Wednesday and the day preceding, anxiously exerting themselves in the furtherance of such measures as were most likely to be attended with a beneficial result. The disease is believed to have had its origin in a vast ramification of courts and alleys abutting upon the rear of the building and scarcely 100 yards from it, filled with tenements of the vilest description, and closely packed with families in the most squalid state of wretchedness and rags, many of them keeping pigs and other animals, and vegetating in a mass of filth that is truly shocking. All these "courts" and "gardens" are constantly immersed ankle-

deep in mud, decaying vegetables, and other refuse; the contents of the cesspools of many of the houses are incessantly percolating upon the mould and footpaths for want of channels to properly carry them off; and the only idea of a sewer amongst the whole of them is represented by the registrar to be an open ditch, the fœtid miasma exhaling from which is intensely more powerful and deleterious than even the other abominations surrounding. In one of these courts a man died of cholera on Thursday or Friday, was followed to the grave by his wife, in apparent health, and in three days afterwards she also was dead; in another alley a second man and his wife perished in a similar manner; and in a third a woman, who had previously lost a child, was suddenly seized with the same disease, and died in a few hours succeeding. These undrained nuisances are suspected to have been the cause of this malignant disorder exhibiting itself amongst the inmates of the Refuge for the Destitute; but it is considered remarkable, as they have for years existed, that the disease should have so suddenly and fatally taken hold of that institution, where it is stated to have never previously shown itself, and it is anticipated that, for the satisfaction of the many benevolent persons interested in it, an inquest will be held upon one of the unfortunate sufferers by the unlooked-for calamity.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Samuel Lees, of the firm of Hannah Lees and Sons, of Park-road, in the county of Lancaster, iron-manufacturers, for certain improvements in the manufacture of malleable iron. Patent dated August 8th, 1848. Enrolled February 8th, 1849.

The improvements described in this specification relate to the manufacture of malleable iron—first, as to the mode of arranging and forming the piles and faggots; and second, the construction of the machinery to be employed in rolling and manufacturing such piles or faggots into bars, rods, &c.

The first of the improvements consists in placing the plates or bars of iron of which the pile is to be formed in such manner that the grain of the iron of the several pieces shall be in different relative positions to each other. In the ordinary mode of forming the piles, the flat bars of iron which compose them are merely placed in regular order one upon another until the required thickness is obtained; the width of the bars being equal to the width of the pile. This mode of piling, when rolled out into bars, rails, &c., presents an exterior surface, upon which the junctions of the bars appear, and thus render them very liable to laminate; as also the strength of the article manufactured is irregular, in consequence of the lamilar direction of the grain. This is particularly the case in railway bars, where, by the action of heavy weights rolling over them, the upper surface is laminated; moreover, the middle vertical web of the rail is comparatively weak from the cross direction of the grain of the iron. The patentee piles his faggots in the following manner:—The sides of the pile are formed of plates, or flat bars, which are dovetailed or overlapped at the edges. These plates, when placed together, form the exterior of the shell of the pile, and present their sides outwards; thus the grain of the iron is in a better position. The middle portion is to be filled up by other plates or flat bars, either in the same way, or by dovetailing the edges, but in both cases so arranging them that their sides, and consequently the grain of the metal, are in different positions.

The patentee also forms piles in which the exterior shell, or case, is formed in the manner described, but the interior is filled with plates, or flat bars, piled or placed in the ordinary manner. He likewise describes, and illustrates in the drawings accompanying the specification, a mode of forming the pile from which hollow shafts are to be made. This pile, formed in nearly the same manner as the preceding, differing only in the employment of two peculiar-shaped bars for the centre of the pile, which, when placed together, form the hollow or cavity required. For the manufacture of grooved or fluted rollers, such as are used in several of the processes in the cotton manufacture, the patentee describes a mode of proceeding. The shell, or case, of the pile is to be made of the four plates or bars, as before described, and the interior to be filled up with the best scrap iron, and then manufactured up in the usual manner. The patentee specifies the kinds of iron he proposes to manufacture from piles thus formed and arranged,—as angle iron, tee iron, bar iron, railway bars, fluted or grooved rollers, shafts, piston and pump rods, &c.

The second of the improvements described is that relating to the machinery to be employed for the manufacturing and rolling the piles formed as above described. This part of the specification is subdivided into two parts. First, the construction of the rollers to be used in rolling the plates or flat bars into the desired shape to form the piles; and also the application to the rollers of a bar or mould, for the purpose of preserving the form of the groove or recess previously formed while passing between the rollers upon its edge. This bar or mould is fixed to the framing of the rollers, and thus allows the grooved bar to slide over it whilst being drawn between the rollers; the bars being successively passed between the latter until of the proper size. Secondly, the employment of two distinct sets of rollers for rolling the bars, &c.; these two sets are placed side by side, and are to be driven in opposite directions; so that the bar, after passing through between one set of them, is returned through between the rollers of the other set to its original place, before the first set is ready again—thus obviating the necessity of returning the bar over the upper roller to its former place in front of them, as is usually done in the old process.

The third improvement relates to the mode of supporting the bars of iron as they are passed between the rollers by a carriage over head, and to which a traversing movement is given, for the purpose of bringing the bar of iron before the grooves in the rollers in their proper order; there is also communicated to the carriage a traversing motion for the purpose of bringing it back.

The fourth part describes a mode of straightening bars of iron after having been rolled. This the patentee proposes to do simply by means of their contraction during cooling. The bar to be straightened is taken, while still hot, and placed upon a flat iron plate, or bed, to which, by clamps, or other convenient means, the ends of the bar are firmly secured; the contraction upon cooling being sufficient to straighten the bar.

The patentee claims:—

First. The mode of forming the outside of a pile or faggot of iron, by placing plates or flat bars of iron together at right angles to each other, the edges or corners of them being dovetailed or overlapped, the interior being filled either with scrap iron or with iron plates, whether arranged upon one another or at right angles to each other.

Secondly. The use and employment of the bar, or mould, attached to rolling-mills, for preserving the form and shape of the groove or indentation upon the bar under operation, whilst it is being passed between the rollers upon its edges. And also the employment of two distinct sets of rollers, which are driven in opposite directions.

Thirdly. The mode of actuating, and also reversing, the movements of the carriage for holding the bars.

Fourthly. The mode described of straightening bars of iron by taking advantage of the contraction which the heated bars experience upon cooling.

PATENTS RECENTLY GRANTED.

John Giblett, of Trowbridge, in the county of Wilts, gentleman, for improvements in the manufacture of woollen cloth. Patent dated February 10th, 1849; six months.

George Edmund Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, both in the county of York, for improvements in the apparatus used for stopping steam-engines, and other first movers. Patent dated February 12th, 1849; six months.

Jarvis Palmer, of Camberwell, in the county of Surrey, merchant, for improvements in matches, lighters, and similar articles for igniting combustible bodies; in the mode or modes of manufacturing the same, and in machinery applicable therein; also in match and other boxes, and in machinery for manufacturing the same. Patent dated February 12th, 1849; six months.

William Harris, of Battersea, in the county of Surrey, shoemaker, for a new or improved mode of preparing leather. Patent dated February 12th, 1849; six months.

William Brewer, of Malcolm-place, Clapham, in the county of Surrey, and John Smith, of Southville, South Lambeth, in the county of Surrey, manufacturers, for certain improvements in the manufacture of paper and cardboard, and in producing watermarks thereon; and also in apparatus and machinery to be used for such purposes. Patent dated February 12th, 1849; six months.

Christopher Nickels, of York-road, Lambeth, in the county of Surrey, for improvements in the manufacture of woollen and other fabrics. Patent dated February 12th, 1849; six months.

Edward Newton, of Chancery-lane, civil engineer, for improvements in engines, and apparatus principally designed for pumping water. Patent dated February 12th, 1849; six months.

Matthew Townsend, of Leicester, framework-knitter, and David Moulden, of the same place, framework-knitter, for improvements in machinery for the manufacture of looped fabrics. Patent dated February 13th, 1849; six months.

Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for hulling and polishing rice and other grain or seeds. Patent dated February 13th, 1849; six months.—(Communication.)

Edward Lord, of Todmorden, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances. Patent dated February 13th, 1849; six months.

Achille Chaudois, of the Faubourg du Temple, Paris, manufacturing chemist, for improvements in extracting and preparing the colouring matters for orchil. Patent dated February 14th, 1849; six months.

William Chambers Day, of Birmingham, in the county of Warwick, ironfounder and weighing-machine-manufacturer, for improvements in machinery for weighing. Patent dated February 14th, 1849; six months.

Hugh Lee Patinson, of Washington-house, Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or compounds of lead, and the application of a certain compound or compounds of lead to various useful purposes. Patent dated February 14th, 1849; six months.

Richard Ford Sturges, of Birmingham, in the county of Warwick, britannia-ware-manufacturer, for improvements in the manufacture of candlesticks and lamp pillars. Patent dated February 14th, 1849; six months.

John Erwood, of Hoxton, in the county of Middlesex, paperhangings-manufacturer, for improvements in the manufacture of paperhangings. Patent dated February 15th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND FROM THE 24TH OF NOVEMBER, 1848, TO THE 22D OF JANUARY, 1849.

Joseph Lewis, of Salford, in the county of Lancaster, machine-maker, and William M'Lardy,

of the same place, manager, for certain improvements in machinery or apparatus applicable to the preparation and spinning of cotton, wool, silk, flax, and other fibrous substances. Sealed November 27th, 1848; six months.

John Harris, of No. 4, Richards-terrace, Albion-street, Rotherhithe, in the county of Surrey, engineer, for a mode or modes of founding types, and of casting in metal, plaster, and certain other materials. Sealed November 28th, 1848; four months.

Alexander Parkes, of Birmingham, in the county of Warwick, chemist, for improvements in the manufacture of metals and in coating metals. Sealed November 30th, 1848; six months.

Alexander Belfour, of Dundee, in the kingdom of Scotland, leather-merchant and manufacturer, for improvements in apparatus for cutting metal-washers and other articles, and in the construction of buffers. Sealed December 4th, 1848; six months.

Christian Schiele, of Manchester, in the county of Lancaster, mechanician, for certain improvements in the construction of cocks or valves, which improvements are also applicable for reducing the friction of axles, bearings, or other rubbing surfaces of machinery. Sealed December 4th, 1848; six months.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery or apparatus for winding yarn, balling or spooling thread, yarn, or other fibrous materials. Sealed December 8th, 1848; six months.

Duncan Mackenzie, of Goodman's-fields, in the county of Middlesex, manufacturer, for certain improvements in jacquard machinery, for figuring fabrics and tissues generally, and apparatus for transmission of designs to the said jacquard machinery, parts of which are applicable to playing musical instruments, composing printing types, and other like purposes. Sealed December 22d, 1848; six months.

Stephen Taylor, of Ludgate-hill, in the city of London, gentleman, for certain improvements in the construction of firearms, and in cartridges for charging the same. Sealed December 26th, 1848; six months.

George Fergusson Wilson, of Belmont, Vauxhall, in the county of Surrey, gentleman, and Charles Humphrey, of Manor-street, Old Kent-road, in the said county of Surrey, merchant, for improvements in the production of light by burning oleic acid in lamps, and in the construction of lamps, and manufacture or preparation of oleic acid for that purpose. Sealed December 28th, 1848; six months.

Robert Angus Smith, of Manchester, for improvements in the application and preparation of coal tar. Sealed January 4th, 1849; six months.

William Gilmour Wilson, of Port Dundas, Glasgow, engineer, for improvements in the formation of moulds, and cores of moulds, for casting iron and other substances. Sealed January 4th, 1849; six months.

Edward Schunck, of Rochdale, in the county of Lancaster, chemist, for improvements in the manufacture of malleable iron, and in treating other products obtained in the process. Sealed January 8th, 1849, six months.

David Yoolow Stewart, of Montrose, in the kingdom of Scotland, ironfounder, for improvements in the manufacture of moulds and cores for casting iron and other substances. Sealed January 10th, 1849; six months.

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner Farmer, of Lyon's-wharf, Upper Fore-street, Lambeth, in the county of Surrey, for improvements in smelting copper. Sealed January 10th, 1849; six months.

John Wright, of Camberwell, in the county of Surrey, engineer, for improvements in generating steam and evaporating fluids. Sealed January 10th, 1849; six months.

Richard Roberts, of the Globe Works, Manchester, in the county of Lancaster, engineer, for certain improvements in, and applicable to, clocks and other timekeepers, in machinery or apparatus for winding clocks and hoisting weights, and for effecting telegraphic communication between distant clocks and places by other means than by electro-magnetism. Sealed January 11th, 1849; four months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam-engines. Sealed January 12th, 1849; six months.

Israel Kinsman, late of New York, but now of Ludgate-hill, in the city of London, merchant, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluids. Sealed January 12th, 1849; six months.

Edward Smith, of Kentish-town, in the county of Middlesex, blind-manufacturer, for improvements in window-blinds, and in springs applicable to window-blinds, doors, and other like purposes. Sealed January 16th, 1849; six months.

Andrew Lamb, of Southampton, in the county of Hants, engineer, and William Alltoft Summers, of Milbrook, in the county of Southampton, engineer, for certain improvements in steam-engines and steam-boilers, and in certain apparatus connected therewith. Sealed January 16th, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in the construction of stoves, grates, furnaces, or fireplaces for various useful purposes. Sealed January 17th, 1849; six months.

Andrew Shanks, of Robert-street, Adelphi, in the county of Middlesex, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. Sealed January 17th, 1849; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Sealed January 17th, 1849; six months.

James Young, of Manchester, in the county of Lancaster, manufacturing chemist, for improvements in the preparation of certain materials, and in dyeing and printing. Sealed January 19th, 1849; six months.

PATENTS RECENTLY EXPIRED.

R. Hill, of Tottenham, gentleman, for certain improvements in certain methods of letterpress printing by machinery. Patent dated February 12th, 1835; expired February 12th, 1849.

E. Norris, of Walworth, gentleman, for an improved machine for letterpress printing. Patent dated February 12th, 1835; expired February 12th, 1849.

J. Allcock, of Worcester, lace-manufacturer, for certain improvements upon certain machinery for making bobbin-net lace, being further extensions of certain improvements for which letters patent were granted to him on the 8th of December, 1832, part of which extensions are for the purpose of producing ornamented bobbin-net lace. Patent dated February 12th, 1835; expired February 12th, 1849.

J. Hendry, of London, surveyor, for an improved method in laying down, or a new combination in the construction of, floors in buildings. Patent dated February 16th, 1835; expired February 16th, 1849.

J. Price, of Gateshead, flint-glass-manufacturer, for certain improvements in railways, and in the means of transporting carriages from one level to another. Patent dated February 16th, 1835; expired February 16th, 1849.

S. Burrell, of Birmingham, manufacturer of gilt toys, for an improved method of manufacturing buttons for clothes. Patent dated February 16th, 1835; expired February 16th, 1849.

S. Slocum, of Middlesex, engineer, for a certain improvement or improvements in machinery for making nails. Patent dated February 16th, 1835; expired February 16th, 1849.

BOTANICAL SOCIETY OF LONDON.

Friday, February 2, 1849.—John Reynolds, Esq., treasurer, in the chair.

Various donations to the library were announced, and six new members were elected.

British plants had been received from Mr. Hewett Watson, Mr. A. Henfrey, Mr. G. Reed, Dr. Bidwell, Mr. F. J. A. Hort, the Rev. John Bigge, Mr. G. Francis, Mr. G. Maw, the Rev. W. R. Crotch, Mr. A. H. Balfour, Mr. G. Lawson, and Miss M. Beevor; and foreign plants from Mr. G. Francis.

Several specimens from Mr. Hewett Watson, Mr. F. Barham, Mr. W. H. Purchas, and Mr. S. P. Woodward, in illustration of recently distinguished species, curious varieties, &c., were exhibited. Among them were examples of Hieracium alpinum, with the scapes branched and leafy, showing a transition to the section of stem-producing species. Also a curious example of Carex atrata, in which the character and position of the flower spikes were widely different from their ordinary condition, giving to the specimen a first-sight appearance similar to that of a very luxuriant C. rigida, the terminal spike being almost entirely male and cylindrical, four inferior spikes of female flowers, with a few males interspersed, cylindrical, or oblong, erect, and placed rather distinctly one below another, the lowest about three inches beneath the terminal male spike. The specimen had grown in Mr. Watson's garden on a root of Carex atrata, brought from the Grampians a few years ago.

CITY COURT OF SEWERS.

On Tuesday, the 20th inst., the commissioners assembled in the Guildhall. Mr. Deputy Peacock in the chair.

SANITARY IMPROVEMENTS.

Mr. H. Lowman Taylor asked whether anything had been done as to the removal of the nuisance in the pauper burial-ground near Farringdon-street, of which complaint had been made by the medical officer?

Mr. Daw (the chief clerk) said the order of the court granted upon Mr. Simon's certificate that the nuisance existed had been sent to the churchwardens, and that no burial had taken place in the ground since the issue of that authority.

The Chairman said the ground was undergoing examination, and he had every reason to believe that the churchwardens in all the City parishes would be very cautious in permitting burials in places which were known or suspected to be crowded, to the injury of the living. He trusted that their vigilance in preventing the public from being annoyed by such nuisances would be increased by the knowledge that for every corpse allowed to be put under ground, in opposition to the medical officer's certificate and the court's order, the penalty of £20 was recoverable, and that the court would inflict it without the chance of modification.

Several courts and alleys were reported by the inspectors as requiring to be drained.

Mr. Deputy Harrison said he had been given to understand that the parochial churchyard of St. Michael's, Cornhill, was in a most horrible condition. It was, he was told, to be opened on Wednesday, for the interment of a body, in the middle of the day, and it would be advisable to cause an inspection of the place to be made at the time.

Mr. Waterlow stated that about five years ago, when he was churchwarden, the burial-ground of St. Michael's was so densely crammed with bodies that it was considered necessary to treble the burial fees. He regretted to say that so salutary a resolution had been subsequently rescinded by the vestry.

Mr. Hopgood considered Mr. Waterlow's testimony as to the crowded state of the burial-ground decisive as to the impropriety of burying there any longer, and hoped the examination would be immediate.

Mr. Simon considered it to be his duty to examine such places of interment as were represented to him by the corporation as being likely to be injurious to the public health, and he would feel much indebted to any members of the court if they would, from time to time, afford him information upon the subject.

The court at once adopted the view of Mr. Simon, and directed that information should be supplied to him of the exact time at which the burial was to take place on the following day.

Report of the Board of Health.—The report of the Board of Health, which was ordered to be printed at the last court, was then taken into consideration. A long discussion took place upon the several recommendations contained in it, all of which were agreed to with the exception of the following:—"That slaughtering of any kind of cattle in cellars or vaults below the level of the ground be absolutely prohibited from a day to be fixed."

The discussion of that recommendation was adjourned on account, we understand, of the great variety of interests involved in it.

THE SURFACE OF THE MOON.

At the last meeting of the Belfast Natural History Society, Dr. Romney Robinson, astronomer royal, Armagh, delivered a lecture on the physical characteristics of the moon's surface, as exhibited by recent telescopic observations. In the course of his lecture the learned doctor said:—The observations of the moon through a powerful telescope have confirmed, to a considerable extent, the anticipations of the ancients; at the same time, in other and very remarkable respects, they have shown the most striking points of difference. Three of these are important, as showing the difference between the moon and the earth. The first is, that while the earth revolves round its axis in twenty-four hours, thus reproducing a quick reciprocation of day and night, it is otherwise with the moon, as its days are pretty generally equal to fourteen of our days, and its nights to fourteen of our nights. The second point of difference is, that the moon may be said to have no atmosphere of any description, and no vapour. This is ascertained in various ways by astronomical observation, but the most convincing proof of it is obtained by the occultation of a star by the moon. If there be an atmosphere, it must be perfectly transparent—it must be a thousand times rarer than ours; and if so, it must differ from all other gaseous vapours with which we are acquainted. It follows, from the absence of an atmosphere, that there can be neither clouds, rain, wind, nor frosts in the moon; and that, unlike the mountains of the earth, which show nothing of their principal aspect, owing to the action of the atmosphere, the forms of the mountains, and the various accidents of their surface, are most sharply and clearly defined. The third point of difference between the moon and the earth is the light and spongy character of the materials of which the former is composed. By a peculiar, though slight, mutation of the earth's axis, we have ascertained that the moon is about the 1.80th of the weight of the earth; that a body weighing 6lbs. here would weigh only 1 lb. in the moon; and that a 24-pounder, if it could be fired from the moon, would throw shot six times as far as it could on this earth. By ascertaining the comparative weight of the two bodies, we can also determine their relative specific gravity; and we have found that the density of the moon is, supposing it the same throughout, about the 6.10th of that of the earth. The interior parts of our earth are, however, extremely dense compared with the upper surface. Mr. Francis Bailey ascertained that, owing to the pressure of the superincumbent earth, marble rock would be in the centre of the earth seven times and a half denser than platinum, the weightiest of all metals; and 300 miles under the surface it would be as dense as platinum. The earth would be 100 times denser than it is were it not that the heat of the centre of the earth, which is in a state of ignition, increases the elastic force of the rocks, and resists the pressure of the surface mass. In the case of the moon it is not known whether there exists this central heat or not; but, if we assume an equally intense heat to exist in the centre of the moon, the density of the surface of the latter can be little more than that of a cork. The learned doctor, after stating that it was scarcely possible for him to confine himself to sobriety of language in describing the appearance of the moon as seen through the most powerful telescopes, proceeded to say that the total absence of atmosphere contributes to fill up the extraordinary beauty of a lunar landscape. In the moon the outlines of every rock and crag (within reach of our optical instruments) are seen with the greatest distinctness. On the earth every object at a distance is obscured by the atmosphere, and the outlines of every crag and hill are more or less softened and rounded off by the influence of the same medium; but at a distance of 250,000 miles from the moon every little detail is seen with a degree of sharpness and precision which is perfectly surprising. When looking at the moon through the telescope a great portion of its surface is seen covered with large spots, slightly and differently coloured. By calculating the size of these spots the height of every elevation and the depth of every chasm can be accurately ascertained. Towards the south of the moon is a very mountainous tract of about 1,000 square miles, covered with the most extraordinary peaks—rugged and wild beyond conception, and not presenting one single square mile of moderate level. These immense mural precipices have no counterpart on earth. Humboldt caused a careful search to be made for a precipice on our globe where a stone could be dropped 500 feet without touching an obstacle. The search was in vain. In the moon, however, it has been ascertained that precipices occur running perpendicularly down 25,000 feet. The reasons of this wonderful fact are to be looked for in the atmospheric causes before alluded to, and in the lightness of the rocks in the moon. The finest range of mountains in the moon are called the "Apennines." To the north they rise abruptly to a height of 14,600 feet. Southwards this chain spreads into a chaos of stupendous mountains, 17,000 miles square—a series of fearful summits, deep ravines and gullies. North and west of this chain are the "Alps," in which a gigantic cleft runs through the highest parts. Another class of mountains occur in the form of long chains, from 300 to 400 miles in length. Others are of a type wholly different, and are termed "ring mountains." These are monstrous circular cavities, some of them 150 miles in diameter. The next feature on the moon's surface are the seas, as they have been styled by the ancients; but as they are not fluid they should be rather termed plains. They present the appearance of places where seas have been. The class of objects called rills—or more properly rifts—are very conspicuous near the centre. The course of one is 104 miles long, three quarters of a mile wide; it runs through a dozen craters. The learned doctor, after giving distinguished authorities in favour of the old idea that the "ring mountains" are craters of volcanoes, went on to state a number of objections to that theory. He next, in reply to a continually put question—"Is the moon inhabited? and if so, are its inhabitants analogous to ourselves?"—proceeded to say:—My answer must be in the negative. There is no air to breathe, no water to drink, no vegetation to support life, no possibility of communication on the fearful abysses of land, and no seas to traverse. Supposing inhabitants to exist, they must be morally as well as physically unlike us. We are endowed with certain faculties, which we must use; we build cities, we clear forests, we unite and, alas! war with one another. With Lord Rosse's six-feet reflector an object of 100 yards in diameter can be discovered; any variation of colour on the side face can be ascertained; a town like Belfast, with the spiring chimneystacks of its manufactories, could not be overlooked. Yet nothing of this has been seen. All is still, immoveable, and dead—not the slightest trace of any visible living being. We must then suppose that the moon is not intended, at least at the present time, for the support or habitation of any living thing, such as exists on our earth. There is, however, sufficient connected with her to call forth irresistibly the recognition of the power, and wisdom, and glory of the Great Being who created her, and who has endowed us, His creatures, with faculties to seek, however faintly, for the evidences of His work in the worlds that surround us.

Nigellin.—Nigellin is a yellowish liquid obtained by Rensch from the seeds of the Nigella sativa. It is produced by digesting the seeds in alcohol of 80 C., distilling the tincture, separating the reddish-brown from the lighter portion of the product, agitating the latter with ether, and subsequently with water; decanting the liquid, adding to it a little subacetate of lead, filtering it, and treating the filtrate with sulphuretted hydrogen. The aqueous liquid is then again filtered, and finally evaporated.

TO CORRESPONDENTS.

"Sagapenum."—Common hearthstone will take grease spots out of stone; it may require repeated application. Or, you may try fullers' earth, made into a paste, which should be left on the spots for seven or eight days.

"J. P., Leicester."—All attempts to condense atmospheric air to liquidity have hitherto proved unsuccessful. We are much obliged to you for the kind opinion which you are pleased to express of "Our Own Series." Try boiling nitric acid; but it would appear that the glass has been corroded, in which case, of course, every attempt at removing the apparent coating would prove unavailing. You should never use glass stoppers for bottles containing caustic alkalis.

"J. N. T."—Dumas'. You may also consult Berthollet's "Eléments de l'Art de la Teinture," or Dr. Bancroft's "Treatise on Permanent Colours."

"Mr. J. Smith, of Bootle."—The artificial hatching of eggs has been tried on a large scale as an industrial speculation. We have reason to believe that it has turned out a failure. If any of our correspondents can give us more detailed and (perhaps) more satisfactory information on the point we shall be glad to insert it.

"T. L., Limerick."—To enable us to give a satisfactory reply to your *many* questions we should be compelled to analyze the several parcels which you have forwarded to us, and those analyses would involve an expense of several pounds. Judge, then, whether we are able to comply with your request.

"Mr. Richardson, Swansea."—Procure Fresenius's "Qualitative and Quantitative Chemical Analysis" (Churchill).

"A Subscriber."—Consult the specification of Mr. Staite's and Chevalier Lemolte's patents (*Chemical Times*, Nos. 126 and 127). The best way would be to address yourself to one of the physiological and mathematical instrument makers. We do not think the apparatus will be very expensive.

"Inquirer."—Next week.

Mr. L. Arnott, Birmingham.—Bisulphuret of iron (the iron pyrites of mineralogists) exists abundantly in the earth. It has usually a yellow colour and metallic lustre, but it is absurd to say that it could ever be mistaken for gold by any one who possesses the slightest knowledge of the subject. The density of the native bisulphuret of iron is 4.981, that of gold is 19.3. Pure gold is exceedingly soft and flexible, the bisulphuret of iron is so hard that it strikes fire with steel. You might just as readily, and even more readily, mistake mosaic gold (bisulphuret of tin) for the genuine article. It is not very likely, at all events, that a Yankee would be taken in by it.

"A Novice."—Zinc is frequently called spelter in commerce. Pewter is an alloy of tin, with small quantities of antimony, copper, and bismuth. The inferior sorts of pewter contain also a large proportion of lead.

"Chemicus," "A Constant Reader," "A New Subscriber," and other correspondents next week.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—February 24, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture VIII.

We concluded the last lecture with carbazotic acid. I mentioned to you that Hofmann found the acid was converted into chloranil by the combined action of hydrochloric acid and chlorate of potassa. Chloranil is a very frequent product of the action of chlorine on bodies belonging to the indigo type, as well as to those of phenyle and salicyle. It may be procured from aniline, isatine, chlorisatine, hydrate of phenyle, nitrophenesic and nitrophenisic acids, hydride of salicyle, salicine, and anthranilic acid, &c. It is best prepared from salicine, which is to be dissolved in boiling water with chlorate of potassa, next hydrochloric acid dropped by degrees into the mixture; the menstruum immediately assumes a deep orange colour, then large quantities of carbonic acid escape, and the surface of the liquid becomes covered with a thick layer of sulphur-yellow crystals of chloranil, possessing a beautiful mother-of-pearl lustre. When the crystals are incipiently heated they sublime without melting; the vapour is yellow. Chloranil is insoluble in water, nearly so in alcohol, and remains intact with nitric, sulphuric, and hydrochloric acids. It dissolves in hot spirits, and, as the liquid cools, fine light yellow iridescent plates deposit. Formula :—

$$C_6\ O_2\ Cl_2.$$

If chloranil be gently warmed with oxide of ammonium and alcohol, a portion of it dissolves with a reddish-brown colour, while chloranilamide remains. It may be purified by washing with spirits of wine, dissolving in potassa-alcohol, filtering while hot, and adding to the filtrate sufficient acid to neutralize the alkali, when the chloranilamide will separate as a crystalline powder, insoluble in all the generally-employed menstrua. Chloranil in a hot solution of potassa gives, as the liquid cools, purplish splendent prisms of chloranilate of potassa, which, dissolved in water, and heated with sulphuric acid, affords the chloranilic acid.

Decompositions.

$$\underset{\text{Chloranil.}}{C_6\ O_2\ Cl_2} + 2KO = \underset{\text{Chloranilate of potassa.}}{K,\ C_6\ O_4\ Cl} + K\ Cl$$

$$\underset{\text{Chloranilate of potassa.}}{K,\ C_6\ O_4\ Cl} + H\ SO_4 = \underset{\text{Chloranilic acid.}}{C_6\ O_3\ Cl} + K\ SO_4$$

The solutions of the salts of this acid are commonly purple. Before leaving this subject we will offer a few remarks upon the action of potassa upon indigo. Indigo, distilled with fused potassa, you have been told, gives aniline, that substance which has for the last three years afforded such a rich harvest to the investigator. It is always interesting and extremely valuable to science to examine, step by step, the manifold metamorphoses organic matters undergo when acted upon by other bodies; but it is particularly worthy our attention if, by such transformations, combinations arise which we were wont to consider as the immediate products of the vital process.

Valerianic acid especially belongs to that class of bodies whose artificial formation has succeeded in the hands of chemists. Although this may appear somewhat irrelevant to the subject, still it is connected with indigo, and consequently deserves notice. The valerianic acid found ready formed in the root of valeriana officinalis, and lately discovered by Winkler as a constituent of athamantin, a remarkable crystalline matter, extracted from the root of athamantina oreoselinum, was a few years ago obtained by Dumas as the product of oxidation of hydrated oxide of amyle (fousel oil), to which it relates in the same manner as acetic acid does to alcohol :—

$C_4\ H_5\ O + Aq$	$C_4\ H_3\ O_3 + Aq$
Alcohol.	Acetic acid.
$C_{10}\ H_4\ O + Aq$	$C_{10}\ H_9\ O_3 + Aq$
Fousel oil.	Valerianic acid.

Cahours some time afterwards showed that the valerianic acid is formed when fousel oil vapours, in the presence of spongy platinum, are brought into contact with oxygen; corroborated in the Giessen laboratory.

The fine experiments of Stass and Dumas in the production of this acid from oil of potatoes was soon followed by a discovery of a new method of preparing valerianic acid, which excited very great attention. Dumas communicated to the Parisian Academy of Sciences a note from Gerhardt stating that indigo treated with hydrate of potassa yielded valerianic acid in abundance. Here is an instance of a most flagrant error perpetrated by one of France's eminent chemists.

On theoretical grounds alone indigo could not yield valerianic acid, and experiments that I went through proved theoretical deductions to be correct. The acid produced on treating indigo with potassa is no other than acetic, similar in smell to valerianic acid. Gerhardt did not analyze his product, but gave to the world a method for its production on paper. This shows to you how necessary it is for chemists to work slowly and cautiously, and not publish statements unless they are convinced of their correctness. An error emanating from a chemist of standing has baneful effects upon science, and a tendency to place future results of the author in a questionable light.

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLVII.

(LECTURE LXXV.)

EXTRACTIVE.

Section V.—BITTER EXTRACTIVE ASSOCIATED WITH ESSENTIAL OIL.

The plants in which the bitter extractive is associated with essential oil are :—

Hops,
The labiated plants,
The aurantiacæ,
The cruciferæ.

To these we have to add mustard, garlic, and the onion, on account of the great analogy which these three plants bear to the cruciferæ.

HOPS.

The roots of the hop plant (Humulus lupulus) are occasionally used in medicine as a diuretic.

The flowers are considered to possess resolutive and depurative properties.

The flowers (and more particularly the small yellow glands with which the female flowers are covered) contain, according to MM. Payen and Chevalier :—

Volatile oil,
Lupulin,
Resin,
Gum,
Extractive matter,
Traces of osmazome,
Fatty matter,
Malic acid,
Malate of lime and some other salts.

The volatile oil of hops has a yellowish colour, garlic smell, and acrid taste. It is tolerably soluble in water, but dissolves more readily still in alcohol and in ether. It acts upon the animal economy as a narcotic. The sedative action which hops exercise when administered in large doses is due to this volatile oil.

Lupulin, or the bitter principle of hops, is uncrystallizable. It has a yellowish-white colour, and an exceedingly bitter taste. It does not possess the narcotic properties of the oil; but it seems to weaken the digestive faculties considerably.

Lupulin is sparingly soluble in water (one part of lupulin requires twenty parts of water to effect its solution). The aqueous solution of lupulin has the colour of beer; it froths when stirred; it is not precipitated by gallnuts, nor by the neutral or the tribasic acetate of lead. Upon being heated a pellicle forms on its surface; this collects subsequently into a mass, which, carried by the motion of the liquid over the brim of the vessel, fuses there, and runs down the outside of the vessel like melted resin.

Lupulin is very soluble in alcohol, but only sparingly so in ether.

It contains no nitrogen.

The mode of preparing it is as follows :—

Mix the aqueous extract of hops (or rather of the small yellow glands of the female flowers) with a little lime, and treat the mixture with alcohol; evaporate the alcoholic solution to dryness, and dissolve the residue in water. Evaporate the aqueous solution to dryness, and wash the residue with ether.

The resin of hops has a gold-yellow colour which turns orange upon exposure to the air.

DISTILLED WATER OF HOPS.

Take of Hops, 8 parts.
Alcohol of 80 C. (31° Cartier), 1 part.
Water, a sufficiency.

Distil to obtain four parts of product.

INFUSION OF HOPS.

Take of Hops, 16 grammes.
Boiling water, 1,000 grammes.

Let the hops infuse in the water, and strain.

The infusion of hops is limpid, bitter, and aromatic; it contains lupulin and volatile oil.

ALCOHOLIC TINCTURE OF HOPS.

Take of Hops, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

F.S.A.

This tincture contains the lupulin, volatile oil, and resin of the hops.

EXTRACT OF HOPS.

Take of Hops, any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Dry the flowers and reduce them to a coarse powder; moisten this with half its own weight of alcohol of 56 C.; twelve hours after, heap the moistened powder closely in a lixiviation apparatus, and treat it with three parts of alcohol of 56 C. Displace the alcohol by means of water, and stop the operation the moment the fluid which runs off produces the slightest appearance of turbidity in the first liquors. Distil the product, and evaporate to the consistence of an extract.

One hundred parts of flowers yield twenty-two parts of extract—with water they yield only fourteen parts.

POMATUM OF HOPS.

Take of The most fragrant hops you can get, 1 part.
Hogslard, 10 parts.

Let the mixture digest, and strain with expression.

This pomatum is recommended against the shooting pains of cancer.

THE LABIATED PLANTS.

The labiated plants are remarkable for the extreme analogy of their botanical characters, and also for the similarity of their medicinal properties.

The principle which predominates in the labiated plants is the volatile oil; this is found in nearly every species of them, but in very different proportions. Some of them, however, such as the Ajugas and several varieties of the Teucrium, contain no volatile oil.

Besides the volatile oil, the labiated plants contain a fixed bitter principle, of which the nature is but imperfectly known to us. It ap-

pears to dissolve in water like extractive, though we cannot say but that its solution may be owing simply to the presence and influence of the other principles with which it is associated in the plants.

Those of the labiated plants in which the bitter principle is not associated with volatile oil are used as tonics and febrifuges. Such are, for instance :—

Ajuga reptans,
Teucrium chamædrys,
Teucrium scordium.

Where the essential oil abounds, it imparts to the plants very energetic stimulating properties. The following plants contain a large proportion of essential oil :—

Mentha piperita,
Mentha crispa,
Mentha polegium, and other varieties of the genus mentha,
Lavandula spica,
Lavandula latifolia,
Salvia officinalis,
Rosmarinus officinalis,
Thymus vulgaris,
Thymus serpyllum,
Melissa calamintha,
Origanum vulgare,
Origanum majorana,
Origanum dictamus,
Plecthrantus graveolens (Patchouly).

Some less aromatic species are employed principally to produce a certain excitation of the pulmonary system, for the purpose of facilitating the expectoration in chronic catarrh. To this class belong :—

Hyssopus officinalis,
Lavandula stœchas,
Marrubium vulgare,
Glechoma hederacea.

The pharmaceutical preparations of which the labiated plants form the basis are divided naturally into three classes, viz. :—

1. Preparations which contain the volatile principle alone.
2. Preparations which contain the fixed principles alone.
3. Preparations which contain both the fixed and volatile principles.

Section I.—*Preparations which contain the Volatile Principle Alone.*

VOLATILE OIL.

The flower tops of the labiated plants yield by distillation a tolerably large quantity of volatile oil.

All the essences of the labiated plants are oxygenated. Nearly all of them deposit in the cold and after long standing a stearoptene.

The stearoptenes of the essences of lavender and spikenard have the same composition as camphor. Others have not yet been examined: this much is known, however, that the stearoptenes of the essences of mentha piperita and mentha viridis have a different composition.

The essential oils of the labiated plants have been studied very insufficiently. It would appear that the essence obtained from one and the same plant is not always identical. Thus it is said that the essence of mint yields a stearoptene only if the flowers have been gathered in full blow.

ESSENCES.

ELÆOSACCHARUM OF PEPPERMINT.

Take of Essence of peppermint, 1 drop.
White sugar, 4 grammes.
Mix.

PEPPERMINT LOZENGES.

Take of White sugar, 96 grammes.
Essence of peppermint, 1 gramme.
Peppermint-water, a sufficiency.
F.S.A.

ENGLISH PEPPERMINT LOZENGES.

Take of White sugar, 128 grammes.
Essence of peppermint, 1 gramme.
Gum arabic,
Gum tragacanth, of each 2 grammes.
Peppermint-water, 16 grammes.

Make into lozenges of sixty centigrammes each.

DISTILLED WATERS.

DISTILLED WATER OF PEPPERMINT.

Take of Fresh peppermint, 1 part.
Water, a sufficiency.

Distil in the steam apparatus to draw off one part of product.

The distilled waters of balm, mentha crispa, hyssop, and ground ivy are prepared in the same way.

DISTILLED WATER OF LAVENDER.

Take of Fresh lavender, 1 part.
Water, a sufficiency.

Distil in the steam apparatus to draw off two parts of product.

The distilled waters of sage and thyme are prepared in the same way.

DISTILLED WATER OF ORIGANUM (WILD MARJORAM).

Take of Dried origanum, 1 part.

Distil in the steam apparatus to draw off four parts of product.

The distilled water of wild thyme (Thymus serpyllum) and the aqua vulneraria are prepared in the same way.

SYRUP OF PEPPERMINT.

Take of Peppermint-water, 100 parts.
Fine white sugar, 180 parts.

Dissolve without the aid of heat, and filter.

The syrup is perfectly colourless.

ALCOHOLATES.

SIMPLE ALCOHOLATE OF BALM.

Take of Fresh tops of balm, 1 part.
Alcohol of 80 C. (31 Cartier), 3 parts.
Distilled water of balm, 1 part.

Let the flowers macerate for five days in the fluid ingredients, and distil subsequently to draw off 2½ parts of alcoholate.

The alcoholate of rosemary, mint, lavender, and, in fact, the simple alcoholates of all the labiated plants, are prepared in the same way.

VULNERARY SPIRIT.

(*Spirituous Vulnerary-water.*)

Take of Fresh leaves and tops of Sweet basil,
" Calamint,
" Hyssop,
" Sweet marjoram,
" Balm,
" Peppermint,
" Wild marjoram,
" Rosemary,
" Savory,
" Sage,
" Wild thyme,
" Thyme,
" Wormwood,
" Angelica,
" Fennel,
" Rue,
Tops of hypericum perforatum (St. John's wort),
Tops of lavender, of each 1 part.
Alcohol of 56 C., 48 parts.

Incise the plants, let them macerate for six days in the alcohol, and distil off 32 parts of product.

Section II.—*Preparations which contain the Fixed Principles Alone.*

These preparations are obtained principally from the inodorous labiated plants. They consist of infusions, extracts, &c.

EXTRACT OF GERMANDER (CHAMÆDRYS.)

Take of Dry tops of germander, any quantity you like.

Reduce the tops to a semifine powder, and lixiviate with water at 68° Fahrenheit. Heat the product, strain, and evaporate to the consistence of an extract.

The extracts of sage, horehound, &c., are prepared in the same way.

Section III.—*Preparations which contain both the Fixed and Volatile Principles.*

§ I. THE ENTIRE PLANT.

AROMATIC OR VULNERARY SPECIES.

Take of Dry leaves of Sage,
" Thyme,
" Wild thyme,
" Hyssopus,
" Mentha aquatica,
" Origanum,
" Wormwood, of each equal parts.
Mix.

§ II. PRODUCTS OBTAINED BY THE ACTION OF WATER UPON THE PLANTS.

JUICE.

The labiated plants are not over succulent, and it is almost invariably necessary to add water to the pulp for the purpose of augmenting the quantity of liquid and facilitating the extraction of the juice. The juice is clarified by simple filtration, or with the aid of heat in a matras.

INFUSION OF GROUND IVY.

Take of Dried ground ivy, 8 grammes.
Boiling water, 1,000 grammes.

Let the ivy infuse in the water for one hour, and strain.

The ptisans of most of the labiated plants are prepared in the same way. As regards those of sage and peppermint, 4 grammes only of the plant should be used to 1,000 grammes of boiling water. Of the non-aromatic plants, such as germander, Ajuga reptans, &c., 16 grammes should be used to 1,000 grammes of boiling water.

AROMATIC FOMENTATIONS.

Take of Aromatic species, 32 grammes.
Boiling water, 1,000 grammes.

Let the species infuse in the water for two hours; strain.

SYRUP OF HYSSOP.

Take of Distilled water of hyssop, 32 grammes.
Dry tops of hyssop, 1 gramme.

Let the tops digest in the water for two hours in a close water-bath. Let the liquor cool, and strain it without squeezing. Add for every 100 parts of the liquor 180 parts of sugar, and prepare a syrup by simple solution in a covered water-bath.

The syrups of ground ivy, Mentha crispa, horehound, water-germander (Teucrium scordium), Lavandula stœchas, and Origanum dictamus are prepared in the same way.

COMPOUND SYRUP OF FRENCH LAVENDER (LAVANDULA STŒCHAS.)

Take of Dry flowers of Lavandula stœchas, 12 parts.
Tops of Thyme,
" Calamint,
" Origanum, of each 6 parts.
" Sage,
" Betony,
" Rosemary,
Seeds of Rue,
" Fennel, of each 2 parts.
Cinnamon,
Ginger,
Calamus aromaticus, of each 1 part.
Water, 500 parts.
Sugar, 310 parts.

Let the plants infuse in the water for twenty-four hours; strain, and distil to obtain 32 parts of product. Convert these into syrup with 58 parts of sugar, in a close vessel. With the residue of the distillation and the remainder of the sugar prepare a syrup by coction and clarification, and mix this with the former.

§ III. PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON THE PLANTS.

RED VULNERARY-WATER.

(*Vulnerary Tincture.*)

Take of Each of the plants which form the ingredients of the vulnerary spirit or spirituous vulnerary water, 1 part.
Alcohol of 80 C. (31° Cartier), 32 parts.

Incise the plants, let them macerate in the alcohol for fifteen days, strain with expression, and filter.

This tincture is brown, and not red, as one would be led to suppose from its name. It contains the volatile oil and the fixed and soluble principles of the plants. The vulnerary spirit (coloured red with cochineal) is sometimes substituted for it; this ought never to be done, however, since the vulnerary spirit contains only the volatile principles of the plants.

§ IV. PRODUCTS OBTAINED BY THE ACTION OF WINE AND VINEGAR UPON THE PLANTS.

AROMATIC WINE.

Take of Aromatic species, 2 parts.
Red wine, 16 parts.
Vulnerary spirit, 1 part.

Let the aromatic species macerate in the wine for eight days; strain with expression, filter, and add the vulnerary spirit to the filtrate.

VINEGAR OF LAVENDER.

Take of Dry flower tops of lavender, 1 part.
White vinegar, 12 parts.

Let the flowers macerate in the vinegar for eight days; strain with expression, and filter.

The vinegars of rosemary, sage, &c., are prepared in the same way.

AROMATIC VINEGAR.

Take of Aromatic species, 1 part.
White vinegar, 10 parts.

Let the species macerate in the vinegar for eight days; strain with expression, and filter.

AURANTIACÆ.

There exists a great analogy between all the plants of the family of the Aurantiacæ. They all abound in essential oil, which is found enclosed in minute vesicles in various parts of the plant, and principally in the leaves, flowers, and peel.

The fruits are mostly filled with an acid, more or less sweetened, juice, which owes its properties to citric acid. They are enclosed in a thick peel, the outer surface of which contains a multitude of minute vesicles filled with essential oil.

We employ in medicine the following species:—

Sweet oranges—Citrus aurantium,
Bitter oranges—Citrus vulgaris,
Citrons, lemons, and cedrats—Citrus limonium et Citrus medica,
Limes and bergamots—Citrus limetta.

LEAVES.

The leaf of the orange-tree alone is employed in medicine, usually in infusion (12 grammes per quart of boiling water), or in the form of powder, as a stomachic and antispasmodic agent, in doses of from forty centigrammes to one gramme.

FLOWERS.

Orange flowers are considered to possess antispasmodic properties.

We use the flowers both of the sweet and bitter varieties. The latter have a more agreeable and aromatic odour than the former, and are, therefore, mostly preferred. It is for this reason that the orange-flower-water prepared at Paris, and which is made with the flowers of the bitter variety, is superior to that prepared in the south of France, where it is made with the sweet variety.

ORANGE-FLOWER-WATER.

Take of Fresh orange flowers, any quantity you like.
Water, a sufficiency.

Distil in the steam apparatus.

The Pharmaceutical Codex of France prescribes to distil over double the weight of the flowers of product. This product is termed the double orange-water. The simple orange-water is prepared by diluting the double with an equal volume of distilled water.

In the south of France they prepare water of greater strength than the double. This water is sold in commerce under the name of quadruple orange-flower-water, and is obtained by distilling off an equal weight of product to that of the flowers used.

Formerly orange-flower-water was prepared by putting the flowers into cold water and heating; but the product was turbid. M. Botentuit has observed that a limpid product is obtained if the flowers are put into the water only when the latter is boiling.

Orange flowers contain acetic acid, which distils over with the water. Orange-flower-water is accordingly acid, and this is a rather serious inconvenience as regards the orange-flower-water of commerce, which is usually expedited to distant places in badly-tinned copper flasks, where it dissolves in the course of time a portion of the copper. To remedy this M. Boullay recommends to add to the flowers in the still 16 grammes of magnesia for every kilogramme of flowers, in order to saturate the acetic acid. I do not know whether, nor with what success, this recommendation has been followed.

We are indebted to M. Rouelle for the following method of preserving orange flowers:—The flowers are bruised and pounded into a paste, which is then mixed with one fourth its own weight of sea salt. In this state they keep for a long time, and yield a good product upon distillation.

NEROLI.

(ESSENCE OF ORANGE FLOWERS.)

On the distillation of orange flowers a certain quantity of volatile oil separates, which is found floating on the surface of the water. This oil is called Neroli. It has a sweet aromatic odour which differs from that of the flowers. In my opinion it is a product of the alteration of the natural essential oil. The latter is more soluble than neroli, and remains in solution in the water, where its presence may be demonstrated by agitating the distillate with pure ether, and collecting the ether, which will, upon spontaneous evaporation, leave a small quantity of an essential oil, readily soluble in water, and of exactly the same odour as the flower.

Neroli contains a solid crystallizable oil, to which its discoverer, Plisson, has given the name of *Aurade*. This oil may be readily procured by mixing the neroli with alcohol of 85 C., and letting the mixture stand at rest for a few days.

SYRUP OF ORANGE FLOWERS.

Take of Distilled orange-flower-water, 100 parts.
Fine white sugar, 180 parts.

Melt the sugar in the water without the aid of heat, and filter the syrup.

PEEL.

The outer surface of the rind or peel of lemons and oranges contains a multitude of small vesicular cells which enclose a volatile oil. In the soft white part of the peel is found a bitter matter, which has been obtained in the form of a bitter extract, insoluble in ether, soluble in alcohol; this matter has not been much studied as yet. The white part of the peel contains also a crystalline substance apparently related with the series of crystalline resins which are insoluble, or sparingly soluble, in cold alcohol. The name *Hesperidin* has been given to this matter.

The pips contain a bitter crystalline matter, to which Bernays has given the name Lemonin. This principle is insoluble in water and in ether, but very soluble in alcohol and in dilute acids.

ESSENTIAL OIL OF LEMON AND ORANGE PEEL.

The essential oil of lemon and orange peel may be procured either by distillation in the usual way, or by simple expression. To effect the latter, the outer yellow part of the peel is finely grated, and the pulp subjected to the action of the press in a horsehair bag. The expressed liquid separates into two layers, of which the lower consists of water, the upper of essential oil.

The expressed essential oil of the rind of the Aurantiacæ has a most agreeable flavour, and is, in this respect, superior to the oil obtained by distillation. It is invariably coloured, and is less pure than the distilled oil, as it holds in solution some fixed principles.

We prepare both by distillation and simple expression the volatile oils of

Citrus aurantium,
" vulgaris,
" limonium,
" medica,
" limetta.

The following table (by Raybaud) shows the respective quantities of oil obtained by the two processes:—

	By Expression. grs.	By Distillation. grs.
100 bergamots gave 3,550 grammes of pulp, which yielded	80	—
100 of the Citrus medica gave 3,550 grammes of pulp, which yielded	50	72
100 lemons gave 3,500 grammes of pulp, which yielded	60	44
100 limes (Citrus limetta) gave 3,500 grammes of pulp, which yielded	30	34
100 oranges gave 2,600 grammes of pulp, which yielded	80	88

The essential oil of lemons is composed of

C_{10} H_8.

It has accordingly the same composition as the essence of turpentine, but its saturative capacity is double that of the latter. It yields with hydrochloric acid a solid and a liquid camphor, which M. Capitaine and myself have found to be isomeric.

The essence of lemon differs from that of turpentine moreover in odour, and also in this, that the former has a power of rotation to the right, whereas the latter rotates to the left. The same applies to the essences of the other Aurantiacæ, which have all the same composition, the same equivalent, and rotate in the same direction.

The essence of bergamots, however, seems to contain an oxygenated oil; the other essences of the Aurentiacæ contain also a very trifling proportion of oxygenated oil.

ELÆOSACCHARUM OF LEMON OR ORANGE.

Take of Essence of lemons or of oranges, 1 drop.
Sugar, 4 grammes.

Mix.

A better way is to rub the fresh peel with sugar, and to reduce the latter subsequently to a fine uniform powder. Eight grammes of sugar should be used for one orange or one lemon.

ALCOHOLATE OF LEMONS, ORANGES, &c.

Take of Fresh peel of lemons, or oranges, or bergamots, 1 part.
Alcohol of 80 C. (31° Cartier), 6 parts.

Let the peel macerate in the alcohol for three or four days; distil to dryness in the water-bath.

EAU DE COLOGNE.

Take of Essential oil of Bergamots,
" Lemon,
" Limes (Citrus limetta),
" Oranges, of each 16 grammes.
" Cedrats (Citrus medica),
" Rosemary,
" Lavender,
" Orange flowers, of each 8 grammes.
" Cinnamon, 4 grms.
Alcohol of 88 C. (34° Cartier), 1,500 grammes.

Dissolve the essences in the alcohol, let the solution stand for a few days, and then distil in the water-bath nearly to dryness; add to the product—

Compound alcoholate of balm, 200 grammes.
Alcoholate of rosemary, 30 grammes.

TINCTURE OF ORANGE PEEL.

Take of Peel of bitter oranges, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the peel macerate in the alcohol for fifteen days; strain with expression, and filter.

This tincture contains both the bitter and aromatic parts of the orange.

SYRUP OF BITTER ORANGES.

Take of Peel of bitter oranges, 1 part.
Boiling water, 7 parts.
White sugar, about 10 parts.

Pour the boiling water over the peel, and after twelve hours' infusion strain with expression; filter the liquid, and dissolve the sugar in the filtrate in a close vessel, in the proportion of 180 parts of sugar for every 100 parts of liquid.

Ten grammes of this syrup correspond to one half gramme of peel of bitter oranges.

SYRUP OF PEEL OF SWEET ORANGES.

Take of Fresh peel of sweet oranges, 1 part.
Boiling water, 5 parts.

Infuse for twelve hours, strain with expression, and filter. Dissolve in the filtrate 180 parts of sugar for every 100 parts of liquid.

DIAMAGNETISM AND THE CRYSTALLINE POLARITY OF BISMUTH.

A LECTURE DELIVERED AT THE ROYAL SOCIETY, FEBRUARY 26.

By Professor FARADAY.*

It has been thought that certain facts which have come out from investigations in which I have lately been engaged have sufficient interest to be made the subject of a special lecture here. I shall be happy if I can communicate to those present some idea of those views which have suggested themselves to my own mind, and which are, as I trust, connected with results of the greatest importance to subjects which have been hitherto mysterious, and on which our knowledge has been uncertain. I hope to experience the forbearance of those present if, in endeavouring to communicate that information at once, with scientific precision, and in a popular manner, my habits of thinking and speaking may betray me into expressions less lucid than I might deliberately choose, at the same time I promise to exercise the greatest diligence in avoiding all occasion of misapprehension.

Those who are in the habit of paying attention to the general properties of matter, and of investigating its laws, are acquainted with nothing more surprising than the extraordinary progress which has of late years been made in our knowledge of the power of magnetic force, and of the susceptibilities of being acted on by that power. This force really seems to exercise a dominating rule over matter, and some of us even expect to find that its reign is as universal as that of gravity itself. Let us, before proceeding to the consideration of the magnetic property of bismuth, glance at the general nature of the magnetic power. To apprehend clearly how it is that this force is made active in a manner new to our knowledge of the properties of crystalline bodies,—to show a certain relation of matter in virtue of a structural crystalline condition, and in respect of no other quality which the body possesses, and the manner in which we have found it to act in several cases, and perhaps may, one day, detect it in all, all this requires that we should operate with a powerful magnet. The reason of this is, not that the ordinary magnetic influences are weak or insignificant, but because I want to pass beyond them, and to destroy the balance of forces which conceals their existence, and to make this one magnetic force prevail over the rest. So, if I wanted to illustrate the force of gravity, although the law is the same for small bodies as for large ones, I can only exhibit it by means of the earth, for nothing smaller would overcome all the influences at work. In this case I require a large magnet, not because the power of diffused magnetism is insignificant; by far the most powerful influences at work, changing the face of our globe, are those which result from an accumulation of forces individually small, but amazingly multiplied. You cannot take two particles of matter and watch them gravitating towards each other but see how great the amount of force is when you take all the particles of the earth. The electromagnet before us offers this great power. It consists of a massive bar of soft iron, bent so as to present its two ends at the same horizontal level: around this wires communicating with the voltaic battery are wound so as to place the iron within a helix. When a current of electricity is made to pass through the helix the bar of iron instantly acquires the property of attracting another piece of iron; in fact, of assuming all the functions of a magnet in a very high degree. These magnetic properties are transient, and vanish when the electricity ceases to pass through the wire. This arrangement gives me a magnet capable of sustaining an enormous weight which would astonish you could I but digress to exhibit an illustration. The great advantage of operating with a magnet thus constructed is, that I can lay the power on or take it off at pleasure, by approximating the two points where contact is made, or by removing them asunder, breaking contact, as we call it. Now, between the two ends of the piece of soft iron, the poles of this magnet, a space remains, and in this space a force resides, and of course has always resided, but for ages this force escaped the notice of any human eye, and even now we are only beginning to learn something of its extent. It is this space which is at present to be used, and in it, as we all now know, a mighty power exists, acting in virtue of certain emanations which go out from the poles of the magnet which are its limits. It is called the "magnetic field." I suspend a piece of copper by a thread in the magnetic field, which has been twisted; the tendency of the thread to untwist communicates a spinning motion to the copper; having allowed the metal to acquire a certain momentum, I put on the power and the spinning ceases. This experiment shows that the magnet does exert an influence on copper. But of what kind is that influence? Does the magnet attract copper as it does iron. No; let a piece of copper be suspended horizontally between the poles of a magnet, and, instead of its pointing, as iron does, towards the pole of the magnet, it assumes a position at right angles to that taken up by the iron. It presents its sides and not its extremities to the poles. Suspend a bar of soft iron over the poles of a horseshoe magnet so that it may be free to move, and it will attain a state of rest in a position parallel to a line connecting both poles, or in a direction of what has been called the lines of magnetic force. But copper thus suspended vibrates, and ultimately comes to rest in a line equidistant from both poles, and perpendicular to the lines of magnetic force. This is the reason for the cessation of motion in the piece of copper which we suspended by the thread. The copper is a diamagnetic body, and is thus repelled by both poles of the magnet, and the transverse position is imposed upon it. This power pervades the magnetic field in the most complete manner, not only circulating where the copper is, but below, around, and above it.

If I take a ball of copper weighing from four to five pounds, and spin it between the magnets, the same effect is seen immediately the power is laid on. We may make this plain by another experiment. Let us take several copper plates bound together in a bundle, and attempt to move them rapidly between the poles of the magnet, as if sawing the air; we can do so while no magnetic force is passing, but on laying on the power our progress is restrained; the horizontal motion can only be persevered in with considerable exertion. When magnetism was not at work we had no difficulty, but immediately the current was completed by making contact the horizontal motion became slow, and by no means easy of communication. This may be made yet more obvious by taking a copper plate and fixing, so that it turns on a horizontal axis, between the poles of the magnet: by means of a twirling machine we give it a very great rotatory velocity. It moves round very fast indeed, and, if in the first experiment we seemed to be sawing the air, then this copper plate is a circular saw. Now we make contact, and the plate, notwithstanding the momentum it had acquired, is brought to a state of rest almost as soon as contact is made.

I think these two experiments will have conveyed to your minds some notion of the degree of the power which resides between the poles, but also of its energetic influence, not only upon bodies which it attracts, as it does iron, but on those which are diamagnetic in the sense in which that word has been explained. I might go on to show you that no terrestrial body is exempt from the force of magnetism, but that every substance known, not merely those which are inorganic and amorphous, but those which are organic, are acted on in one or other of these ways when brought into the magnetic field. Suppose we take an apple, and cut it so as to have two parallel flat surfaces, and then suspend it in the magnetic field, it soon ceases to vibrate, and takes up a constant position, the transverse position perpendicular to the line which connects the poles of our magnet. If we take a fish, and suspend it in like manner, a similar direction is taken up; its organization has diamagnetic properties. But it is not only on solid bodies that we find a magnetic power exerted. Gases and flames are likewise influenced. Let us just look a little nearer at this singular fact. The apparatus by which we illustrate this phenomenon consists first of a powerful electro-magnet. The two terminal pieces of iron forming the virtual magnetic poles are each 1.7 inch square, and 6 inches long, but the ends are shaped to a cone, of which the sides have an angle of about 100°, the axis of which is horizontal, and in the upper surface of the pieces of iron. The apex of each end is rounded, nearly one tenth of an inch of the cone being in this way removed. When these terminations are brought near to each other they give a powerful effect in the magnetic field, and the axial line of magnetic force is of course horizontal, and on a level with the upper surface of the bars.

Now, when we hold the flame of a wax taper near the axial line, but on one side or the other, the flame is affected, and recedes from the axial line, moving equatorially, until it takes up an inclined position, as if a gentle wind is causing its deflection from the upright position; but the moment we remove the magnetism this effect ceases. When we place the flame so as to rise across the magnetic axis, the effect of the magnetism is to compress the flame between the points of the poles, making it recede in the direction of the axial line from the poles towards the middle of the transverse plane, and also to shorten the top of the flame. At the same time the top and sides of the compressed part burn more vividly, because of two streams of air, which set in from the poles on each side, directly against the flame, and then pass out with it at the equatorial direction. But there is at the same time a repulsion or retrocession of the parts of the flame from the axial line, for those portions which are below do not ascend so quickly as before. Now, if we raise the flame a little more, the effect of the magnetic force is to increase the intensity of all these results, and the flame actually becomes of a fish-tail shape, displayed across the magnetic axis. If the flame is raised until about two thirds of it are above the level of the axial line, and the poles approach so near each other that they begin to cool and compress

* This lecture was delivered to give Prince Albert and other notabilities an opportunity of becoming acquainted with the results of Dr. Faraday's researches in this new and important branch of philosophical inquiry. His Royal Highness evinced a great interest in the subject, and repeated several of the experiments at the close of the lecture.

the part of the flame at the axial line, yet without interfering with its rising freely between them, then on rendering the magnet active the flame becomes more and more compressed and shortened, and as the effects reach their maximum the top at last descends, and the flame no more rises between the magnetic poles, but spreads out right and left, and a double flame is produced with two long tongues. When we throw the magnet out of action the flame resumes its ordinary upright position at once, but is depressed and redivided again when the magnetic action is renewed. If we take a small flame, only about one third of an inch high, and place it between the poles, the magnetic force instantly depresses it to an equatorial disc. If a ball of cotton, about the size of a nut, be bound up by wire, soaked in ether, and inflamed, it will give a flame five or six inches high. When we place this large flame between the poles it rises freely, but as soon as the magnet is rendered active it divides, and passes off into two flames, one of which is on one side and one on the other side of the axial line. If we take the flames produced by alcohol, ether, coal-gas, hydrogen, sulphur, phosphorus, and camphor, we find them all affected in the same manner, though not with equal strength. The brightest flames seem to be most affected. We may observe the diamagnetic tendency as well in smoke as in flame, and the results are yet more striking and instructive. Let us take a taper made of wax, coloured green by verdigris: this, if suffered to burn upright for a minute and then blown out, will usually leave a wick with a spark of fire on the top. This subdued combustion will, however, go on for an hour or more, sending up a thin dense stream of smoke, which in a quiet atmosphere will rise vertically for six or seven inches, and in a moving atmosphere will show every change of its motion, both as to direction and intensity. Now, when this taper is held beneath the poles so that the stream of smoke passes a little on one side of the axial line, the stream is scarcely affected by the power of the magnet, the taper being three or four inches below the poles; but, if the taper be raised so that the coal is not more than an inch below the axial line, the stream of smoke is much more affected, being bent outwards, and if it be brought still higher there is a point at which the smoke leaves the taper wick even in a horizontal direction to go equatorially. If the taper be held so that the smoke stream passes through the axial line, and then the distances be raised as before, there is little or no effect when the wick is four inches below; but, being raised as soon as the warm part of the stream is between the poles, it tends to divide, and when the ignited wick is about an inch below the axial line the smoke rises vertically in one column until about two thirds of that distance are passed over, and then divides, going right and left, leaving the space between the poles clear. As the taper is slowly raised the division of the smoke descends, taking place lower down until it occurs upon the wick. If the taper be raised still more the magnetic effect is so great as not only to divide the stream but to make it descend on each side of the ignited wick, presenting a figure resembling that of the letter W, and, at the same time, the top of the burning wick is greatly brightened by the stream of air that is impelled downwards upon it. Flame and smoke are thus shown to be diamagnetic: the same phenomena are observed in gases. To exhibit this property of gases requires some little management: it may, nevertheless, be done. To enable me to govern the supply of gas to the magnetic field, I make use of the following arrangement:—I take a Woulf's bottle, having three apertures at the top, *a*, *b*, and *c*; a wide tube is fixed into *a*, which descends into the bottle at the bottom, and is open above and below; this is employed for conveying water into the bottle, and displacing gas previously within it. Aperture *b* is closed with a stopper. Aperture *c* has an external tube with a stopper fixed in it to conduct the gas to any locality desired. To expel the gas and send it forward, a cistern of water is placed above the bottle, and its cock so plugged as that when full open it delivers exactly twelve cubic inches of fluid in a minute. This stream of water is directed into aperture *a*, the cock of tube *c* being left open, and thus twelve inches of gas are delivered within a minute of time. To deliver this gas at the magnetic pole I employ a piece of bent glass tube having an aperture of about one eighth of an inch internal diameter. When the gas to be delivered as a stream is heavier than the surrounding medium, the glass tube is bent so as to deliver the gas downwards and over the axial line. In order to trace the course of the gaseous streams a little ammonia vapour will in some instances suffice, but as the little cloud of muriate of ammonia is itself diamagnetic, and the tranquil condition of the air in the magnetic fluid is thus too much disturbed, I prefer to employ catch-tubes, consisting of tubes of thin glass about the size and length of a finger, open at both ends, and fixed upon little stands, so that they may be adjusted either over or under the magnetic poles at pleasure. Now, we have to provide somes means of ascertaining through which catch-tube the gas passes, and for this purpose I hang in each of the tubes a little piece of bibulous paper, folded and bound round, and dipped in the solution of ammonia. The gas is delivered into the field of magnetic action perfectly clear and transparent, but it is made evident, by the visible fume formed at the top of one of the tubes, whether the gas delivered below passes up the one tube or the other, and which. Many gases might be taken to illustrate the diamagnetic condition of this form of matter: hydrogen presents a most striking illustration. This gas, as is well known, has a powerful ascensive force in the atmosphere, because of its small specific gravity, yet when we allow a stream to come into the magnetic field it is drawn out of its course and deflected equatorially. Its diamagnetic state, therefore, shows in a striking point of view that gases, like solids, have peculiar and distinctive degrees of diamagnetic force. We may take carbonic acid gas as another instance of this property. If we deliver the stream downwards, a little on the side of the axial line, and place a catch-tube a little further out, so that the stream may fall clear of it, as long as the magnet is not active we find, on making the magnet efficient, that the stream leaves its vertical direction, passes equatorially, and falls into the catch-tube. Looking horizontally, we can see it flowing out at the lower extremity like a spring, and falling away through the air. If we again throw the magnet out of action, and place a glass with lime-water beneath the lower end of the catch-tube, no carbonic acid appears, though we continually stir the fluid, but the instant the magnet is made the carbonic acid appears in the catch-tube, falls into the glass, and renders the lime-water turbid.

Now we come to the next point to be explained in this lecture, the relation between the magnetic force and the crystalline polarity of bismuth. Bismuth is a very beautiful metal to the physical philosopher, on account of its being almost at the head of those bodies that are called diamagnetic, that is to say, of those bodies which, instead of remaining in a position in the magnetic field in the lines of the magnetic force, vibrate or come to rest in a line equidistant from both poles, and perpendicular to a line connecting the magnetic poles. Among such bodies bismuth is the one which is repelled with greatest force from the poles.

Now, bismuth is a crystalline body, and in virtue of this fact the new phenomena came out. I was casting some cylinders of bismuth by running a portion of the metal into glass tubes, and the bismuth ran into the cupellar part of the tube. I had a certain question to answer for a scientific friend, unconnected with the question of polarity, and in my experiments I expected that the crystals would arrange themselves in the magnetic field, simply according to the known diamagnetic properties of the metal, instead of which certain of the crystals took up a magnetic position different from the rest, and refused to remain in any other. I expected they would arrange themselves at right angles to a line which would connect the poles of the magnet, but some pointed diagonally. They all broke with a clearage plane, just as a crystal does, which showed me that these cylinders were not acting as bismuth only, but as bismuth in a state of crystallization, since in amorphous bismuth these phenomena are not observed. I was thus led to the relation of the magnet to the crystal. When we examine crystals of bismuth we find some among them associated to form a group having the most perfect symmetry in the arrangement of their faces. On this regularity depends their peculiar susceptibility of magnetic influence. I take an arrangement of strands of cocoon silk, about twenty in number, capable of sustaining a considerable weight, and by these I suspend my crystal in the magnetic field: attached to this is a double hook or cradle of thin copper wire, in which my crystal rests. The copper is free from iron, and therefore not magnetic. Now, when I make the magnet active, the bismuth will move and point in a particular direction after a few vibrations. Now, if we take the crystal from its cradle, and so suspend it that the horizontal line, which is transverse to the magnetic axis, shall become the vertical line, the crystal points with a maximum of force. Another point to be noticed is, that which ever way you suspend the bismuth it will point without any reference to permanent poles. The mariner's compass sets in a certain direction with reference to permanent poles, and it might be supposed that bismuth should do the same, but the contrary is the fact. If we take a piece of bismuth, and deprive it of its symmetrical crystalline form, either by breaking it down or by fusion, it loses all this power of pointing, and only retains its diamagnetic character. This fact proves that the phenomena described depend on certain relations of space, a certain arrangement of the particles; in a word, upon the crystalline form of bismuth. Now, having seen the polarity of these crystals, let us ask, where is the line of this polarity? Bismuth, it is said, crystallizes in cubes. That the crystals of this metal approach the figure of the cube I know, but they do not appear to me to be cubes. They have a kind of oblique rhomboid prism form, but they are not exactly cubes. Examine a piece of bismuth, and several planes of clearage present themselves, showing the sides where it has been broken. On further examination it is found that the solid angles of the crystal are taken off by the planes of clearage, and the form is in reality octahedron. Of these planes of clearage, four in number, there is one better than the others, and this one is upon what seems to my eye to be the acute solid angle of the crystal of bismuth. It is on this angle, and not upon all or any of the solid angles, that the line of force travels. This line I call the magne-crystallic axis. If I take a piece of soap, and, shaping it like the crystal, thrust a piece of stick through its plane at this angle, you will have an idea of what I mean by the magne-crystallic axis. It is not merely the large crystal that is capable of this kind of direction. If I take a small one, or, better, a number of small ones, so they be symmetrical, and arrange them all in one direction, I may hang them in the magnetic field, and we shall see the same phenomena as when the larger single crystal was employed. I have been compelled to accept the word polarity in speaking of these phenomena; but it does not express, in my view, the phenomena intended with sufficient accuracy. The fact that bismuth crystallized points in a certain direction, under given circumstances, certainly establishes, as far as it goes, an analogy between the polarity of the magnet and the determinations of the crystalline form of bodies; but I conceive, in the usual

acceptation of the word, the phenomena we have been observing cannot be called polarity. I call it polarity when there is a difference between the two extremities of the substance in the line of its force. But in crystals of bismuth we have no poles pointing always north or south, or east or west; the extremities may be changed for one another; the direction of the line of force, and not a pole, is in question; hence I call this susceptibility of the crystal not polarity but "axiality." I can understand that word better. What is this force—is it attraction or repulsion? If I place a substance like iron in the magnetic field it will not remain quiet there, but one pole will be drawn one way and the other in the contrary direction: it is not so with bismuth. The latter metal does not set in the magnetic space by virtue of any polarity of magnetic force: it is a body repelled by the magnet. If I suspend in a torsion balance a piece of amorphous bismuth, not crystalline, but confused as to the manner in which its particles lie by the side of one another, and bring it into the magnetic field, I find that it is repelled by both poles alike. The crystalline bismuth is not more susceptible of the same force. When we suspend a piece of crystalline bismuth we find that the phenomena of repulsion are manifested, whether the magne-crystallic axis is present, parallel with the line of magnetic force or transversely to it.

From these facts I was led to inquire whether other metals possessed like properties, and I found that antimony, a metal crystallizing in the same manner as bismuth, has this kind of magne-crystallic power, and behaves in the magnetic field precisely in the same manner. It has the same axiality, and takes up the diametrical position, just as bismuth does; and I also find that magnetic bodies are as beautifully magne-crystallic as those which are diamagnetic. I may show this by a salt of iron. Here is a very large prismatic crystal of sulphate of iron. I have been nursing up crystals of this salt in order to get some large ones from which to choose some having their particles symmetrically arranged. I now submit this large crystal of sulphate of iron, a magnetic body, to the magnetic force, by suspending it in the space between the poles from sixty or seventy strands of cocoon silk. The length of the crystal is about four times its breadth, and the cocoon silk is attached to it at right angles, its length being, in fact, its radius.

The magne-crystallic axis is horizontal, and, therefore, as tangent. Now, if, when this crystal of sulphate of iron is at rest, we cause a magnetic force to be so exerted that the axial line of magnetic force shall be oblique both to the length and to the magne-crystallic axis of the crystal, the result is that when the magnetic current circulates round the magnet the crystal actually recedes from the magnet under the influence of its force, which tends to place the magnetic and the magne-crystallic axes parallel with each other. That the length of the crystal does not determine its pointing is plain, for the length is in the line of the magnetic force, but this takes place in consequence of its crystalline structure. We may take a little pasteboard platform, arrange a row of symmetrical crystals on it, and we get the same axial phenomena as with the single crystal. When placed in a line on the pasteboard they may for every purpose be considered as one crystal, for, on placing them in the wire cradle suspended by the silk, we can, notwithstanding their diamagnetic tendency, compel them actually to approach the poles of the magnet. Whether we place them in the line in the first instance, or at an angle of ninety degrees from it, the line of force as regards the crystal stands just as in the last experiment. We now see that the crystals of bismuth have a power of assuming a particular position distinct from that which is common to diamagnetic bodies and yet concurrent with that property. What, then, is this strange force? I believe it is wholly increased power. I do not believe that there is any power inherent in the body itself, any force originating in the crystal, but one arising wholly from induction; at the same time I am free to confess it is a most difficult question. I am not aware of any instance in nature in which a similar power exists where there is neither attraction nor repulsion. There is in mechanics a beautiful theory, the theory of couples, which seems at first sight to suggest an explanation of this condition of matter, but I do not think anything in that theory is really applicable to the present inquiry. I can only say for the present that the force appears to me to be referrible entirely to induction.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE PREPARATION OF VITRIFIABLE PIGMENTS.

By Dr. A. WÄCHTER.

[*Continued from page* 203.]

YELLOW PIGMENTS FOR PORCELAIN PAINTING.

These are lead-glasses coloured either by antimonic acid or oxide of uranium. Antimoniate of potash is prepared by igniting one part of metallic antimony, finely powdered, in a red-hot hessian crucible, with two parts of nitre, and washing the residue with water. Oxide of uranium is best prepared for this purpose by heating the nitrate until all the nitric acid is expelled.

LEMON-YELLOW.

Eight parts of antimoniate of potash, 2½ parts of oxide of zinc, 36 parts of lead-glass (obtained by fusing 5 parts of minium, 2 parts of white sand, and 1 part of calcined borax), are well mixed and heated to redness in a porcelain crucible placed within a hessian crucible so as to form a paste. The mixture is then taken out of the crucible with a spatula, cooled, and pounded, and afterwards ground on a glass plate. Without proper care the pigment is fused more than is necessary to effect the perfect union of the ingredients, and the yellow colour is thus converted into a dirty grey by the decomposition of the antimoniate of lead.

LIGHT YELLOW.

Four parts of antimoniate of potash, 1 part of oxide of zinc, and 36 parts of lead-glass (8 parts of minium and 1 of white sand fused together), are intimately mixed, fused in a hessian crucible, cooled, pounded, and ground. Long fusion does not affect this pigment so much as the former, as there is no borate of soda in the lead-glass. The colour is a much deeper yellow than the preceding, and mixes well with the red and brown pigments, but it is less pure than those of the former when mixed with green. Its specific gravity being higher, it flows more freely from the brush, and is not so liable to scale off after firing when laid on in a thick layer.

DARK YELLOW (I.).

Forty-eight parts minium, 16 sand, 8 calcined borax, 16 antimoniate of potash, 4 oxide of zinc, and 5 parts peroxide of iron (*Caput mortuum*), are well mixed, fused in a hessian crucible just as long as is requisite for the union of the ingredients; if this period be exceeded the beautiful yellow colour becomes a dirty grey.

DARK YELLOW (II.).

Twenty parts minium, 2½ white sand, 4¼ antimoniate of potash, 1 part peroxide of iron, and 1 part oxide of zinc, are intimately mixed, and fused in a hessian crucible. Iron-red pigment may be laid on and near this dark yellow pigment without its being destroyed or the agreement of the tints deranged. These two pigments should be made less readily fusible when it is intended to use them in figure or landscape painting, so that they may be employed upon or beneath other colours without fear of interfering with or being dissolved by those pigments. This lower degree of fusibility is communicated by the addition of Naples yellow, prepared by long-continued ignition of a mixure of tartar emetic, 1 part; nitrate of lead, 2 parts; dry chloride of sodium, 4 parts, in a hessian crucible, the pounded residue being washed with water. This Naples yellow may be mixed with lead-glass to produce some valuable colours, which, however, are more expensive than the others. For landscape painting a very fine yellow is produced by mixing 8 parts of Naples yellow and 6 parts of lead-glass (prepared by fusing 2 parts of minium with 1 of white sand and 1 of calcined borax). The yellow pigments into the composition of which antimony has entered appear under the microscope, not as homogeneous yellow glasses, but as mixtures of a yellow transparent substance and a colourless glass.

URANIUM-YELLOW.

One part oxide of uranium and 4 parts lead-glass (prepared by fusing 8 parts minium with 1 part white sand), are mixed and ground on a glass plate. This colour cannot be mixed with others on account of the disagreement of the tints. It can be shaded with dark purple or violet.

URANIUM-ORANGE.

Two parts oxide of uranium, 1 part chloride of silver, and 3 parts bismuth-glass (prepared by fusing 4 parts oxide of bismuth with 1 part crystallized boracic acid), are mixed and ground upon glass plates. This pigment, like the former, is not adapted for mixing with other colours. When burnt in upon porcelain these pigments appear under the microscope to be pale yellow glasses in which the oxide of uranium exists unaltered.

GREEN PIGMENTS FOR PORCELAIN PAINTING.

BLUE-GREEN.

Ten parts of the chromate of protoxide of mercury and 1 part of purified oxide of cobalt are very intimately mixed on a glass plate, and the mixture heated in a porcelain tube open at the ends till the mercury is entirely expelled. A beautiful blueish-green powder is thus obtained, which is transferred to a porcelain crucible and the lid cemented to it. The crucible is then submitted to the greatest heat of the furnace for one firing, and the crucible broken upon cooling. The pigment is then washed with water, by which a small quantity of chromate of potash is removed. The pigment thus obtained is a compound of oxide of chromium and oxide of cobalt in nearly equivalent proportions, having the blueish-green colour of verdigris. To make the blue-green pigment 1 part of the above compound, ½ part of oxide of zinc, and 5 parts of a lead-glass prepared by fusing together 2 parts minium, 1 part white sand, and 1 part calcined borax, are mixed and ground upon a glass plate. This blue-green may be mixed with the lemon-yellow to produce any intermediate tint that may be required. A beautiful grass-green is furnished by adding 1 part of blue-green to 6 parts of lemon-yellow.

DARK GREEN.

The chromate of mercury is treated by itself, according to the process described for its treatment with oxide of cobalt in the preceding section. 1 part of the fine green oxide of chromium thus prepared is mixed with 3 parts of the lead-glass described under blue-green, and ground.

GREEN FOR SHADING.

Eight parts of chromate of mercury and 1 part of oxide of cobalt are intimately mixed, and exposed in a shallow dish to the strongest heat of the porcelain furnace during one firing. A compound of oxide of chromium and oxide of cobalt is thus obtained of a greenish-black. This mixed with twice its weight of the lead-glass described under blue-green gives a blackish-green colour, infusible, and well calculated for shading other greens. When the green pigments of chromium burnt in upon porcelain are examined with the microscope the particles of the oxide of chromium, or oxides of chromium and cobalt, are seen suspended in the transparent lead-glass, not having been entirely fused.

BLUE PIGMENTS FOR PORCELAIN PAINTING.

DARK BLUE.

One part of purified oxide of cobalt, 1 part of oxide of zinc, 1 part of lead-glass (prepared by fusing 2 parts of minium, 1 of sand, and 1 of

calcined borax), and 4 parts of lead-glass (prepared by fusing 2 parts of minium and 1 of white sand), are intimately mixed, fused in a porcelain crucible for at least three hours at a red heat, poured out, pulverized, and poured upon a glass plate. The pigment is cooled slowly, and becomes solidified to a mass of acicular crystals. The most perfect tint is attained by long-continued fusion at a temperature not too high. This is best effected by fusing it during one of the bakings in the second chamber of the porcelain furnace, a plan which is also recommended for fusing the lead-glass.

LIGHT BLUE.

One part of oxide of cobalt, 2 parts of oxide of zinc, 6 parts of lead-glass (prepared by fusing together 2 parts of minium and 1 of white sand), and 1½ part of lead-glass (prepared by fusing 2 parts of minium, 1 part of white sand, and 1 part of calcined borax), are well mixed and fused, as described under dark blue.

BLUE FOR SHADING.

Ten parts of oxide of cobalt, 9 of oxide of zinc, 25 parts of lead-glass (prepared by fusing 2 parts of minium and 1 of white sand), and 5 parts of lead-glass (prepared by fusing 2 parts of minium, 1 of white sand, and 1 of calcined borax), are mixed and fused as directed under dark blue. This colour is not employed alone, but exclusively for shading. It is very difficult of fusion.

SKY-BLUE.

Two parts of dark blue, 1 part of oxide of zinc, and 4 parts of lead-glass (prepared by fusing together 4 parts of minium and 1 of white sand), are intimately mixed and ground upon the plate. This pigment can only be employed for painting the sky in landscape paintings, either alone or mixed with other colours. All the blue pigments when burnt in upon the porcelain appear to be mixtures of a transparent blue substance and a colourless glass, and not homogeneous blue glasses.

TURQUOISE-BLUE.

Three parts of purified oxide of cobalt and 1 part of pure oxide of zinc are dissolved together in sulphuric acid, an aqueous solution of 40 parts of ammonio-alum added, the mixed solutions evaporated to dryness, and the residue heated to expel the whole of the water, and afterwards reduced to powder, and exposed in a crucible to an intense red heat for several hours. When this has been heated in the porcelain furnace during one firing the colour is really splendid. The compound is a combination of 4 equivs. alumina, 3 oxide of cobalt, and 1 oxide of zinc; it has a most beautiful turquoise colour. Mixed in any other proportions these oxides do not yield such beautiful-coloured compounds. A little moist, newly-prepared protochromate of mercury may be mixed with this solution of ammonio-alum, zinc, and cobalt when it is desired to give this blue pigment a greenish tint. One sixteenth of the chromate, calculated as dry, is sufficient.

The turquoise-blue vitrifiable pigment is prepared by taking 1 part of the above triple compound, and mixing it with 2 parts of a bismuth-glass, prepared by fusing 5 parts of oxide of bismuth with 1 part of crystallized boracic acid. Brongniart, in his "Traité des Arts Céramiques," gives a recipe for the preparation of turquoise-blue pigment which is incorrect.

The lead-glass there given, composed of 3 parts minium, 1 part sand, and 1 part boracic acid, completely destroys the turquoise-blue pigment on fusion, and leaves only a dirty, bluish-grey colour. The turquoise-blue pigment burnt in upon porcelain, and examined under the microscope, appears to be a mixture of a colourless glass with a transparent blue substance. The latter is probably the compound of oxide of cobalt and alumina, which is itself transparent under the microscope, and has its transparency increased by the surrounding glass of bismuth just as the fibres of paper by oil. Perhaps this is also the case with the microscopic constituent of the other blue vitrifiable pigments, which is probably silicate of zinc and cobalt.

[*To be continued.*]

ON THE EQUIVALENT OF FLUORINE.

By Professor LOUYET.

In my former experiments on this subject I had deduced the equivalent number of fluorine from the amount of sulphate of lime obtained from a given quantity of the purest native, and also from a corresponding weight of artificially prepared, fluoride of calcium.

As I had obtained exactly the same amount of sulphate of lime from both fluorides, I thought there was no reason to doubt the correctness of the results, or of the conclusions to which they led. Yet even then I pronounced my opinion with some reserve, since, having ascertained that sulphuric acid does not completely decompose fluoride of lead, it occurred to me that this acid might perhaps equally fail in effecting the complete decomposition of the fluoride of calcium.

The circumstance that the analysis of fluoride of lead gave a higher equivalent number for the fluorine than I had deduced from the analysis of the fluoride of calcium naturally tended to strengthen my doubts on the point.

I had fixed the equivalent of fluorine at 239.81. This number must be raised, however, to 240, taking the equivalent of calcium at 250, that of sulphur at 200.

Taking these numbers to be correct, 1 grm. of fluoride of sodium ought to yield 1.680 grm. of anhydrous sulphate of soda. The decomposition of the fluoride of sodium by means of sulphuric acid is almost unavoidably attended with loss. It appears, indeed, certain that the vapours of the sulphuric acid carry off minute traces of the sulphate of soda; moreover, the complete decomposition of the alkaline bisulphate formed requires a protracted exposure of the crucible to a strong red heat,—another source of error on the diminution side of the results.

In three experiments which I made, each with 1 gramme of fluoride of calcium, I obtained respectively 1.686, 1.685, 1.683 of anhydrous sulphate of soda, and, consequently, in all three experiments higher figures than that calculated upon the assumed equivalent of fluorine at 240.

These results led me to repeat the analysis of fluoride of calcium. In five experiments, made each with 1 gramme of that substance, I obtained respectively 1.742, 1.744, 1.745, 1.744, 1.7435, 1.7435 — mean: 1.7436 grm. of sulphate of lime.

Now, assuming the equivalent of fluorine to be 237.50 (instead of 240), 1 gramme of fluoride of calcium shauld (theoretically) yield 1.74358 gramme of sulphate of lime.

The correct equivalent of fluorine is accordingly 237.50, and not, as I formerly believed and stated, 240.

This result I have verified by the analysis of other fluorides. In three experiments made, each with 1 gramme of fluoride of barium, I obtained respectively 1.332, 1.331, 1.330—mean 1.331 gramme of sulphate of baryta. Taking the equivalent of fluorine at 237.50, 1 gramme of fluoride of barium should yield 1.33090 of sulphate of baryta.

The difference between the equivalents respectively deduced from the result of the analysis of fluoride of lead and fluoride of calcium is to be attributed wholly to a source of error arising from the vast difference between the respective equivalents of lead and of fluorine, and which must necessarily make the most trifling error in the analysis lead to considerable differences in the calculated results as regards the substance of the less equivalent, viz., the fluorine. In three experiments, made each with 5 grammes of fluoride of lead, I obtained respectively 6.179, 6.178, 6.178 grammes of sulphate of lead. Theoretically 5 grammes of fluoride of lead should yield 6.1828 grammes of sulphate of lead. The results which I obtained in the three experiments were accordingly below the calculated number.

In my first memoir on fluorine and the fluorides I combated Ampère's hypothesis, according to which fluorine is ranged with chlorine, bromine, and iodine. The estimation of the equivalent of fluorine at 237.50—an exact multiple of that of hydrogen—strongly tends to confirm the correctness of my view on the subject, viz., that fluorine is an associate of the series of oxygen, sulphur, phosphorus, nitrogen, arsenic, and carbon, the equivalents of which substances are all exact multiples of that of hydrogen, whereas the equivalents of chlorine, bromine, and iodine are not so.

ON THE CONSTITUENTS OF THE IVY SEED.

By Prof. L. POSSELT.

The Hedera helix is a plant belonging to a family having no other representative in Europe. Its seeds contain albumen in an unusually developed condition, no starch, and little fat. Seeds of this class have been very little examined, and we scarcely know what substances act in them the part of these non-nitrogenous compounds. It appeared to the author that an examination of the ivy-seed would, on these accounts, be interesting. In all seeds non-nitrogenous substances must exist by the side of the nitrogenous albumen, &c., while in the ivy-seed the starch is altogether wanting, and no very large quantity of fat is present. It appeared to me probable that some peculiar compounds would be found replacing those in germination. The taste of these seeds suggests the presence of some peculiar compound: it is excessively acrid, and produces an unpleasant sensation of dryness in the larynx, which lasts some time. The fruit of this plant is a berry about the size of a pea. It appears to me to consist mainly of pectine, as it forms a stiff jelly even with a large proportion of water. I have not, however, submitted the fleshy part to an examination. In this fleshy part there are situated some seeds of the size of the Semen cynosbasti. They contain, as far as my examination entitles me to speak, 1st, a nitrogenous substance like emulsine; 2d, fat; 3d, two peculiar acids; 4th, sugar; and, lastly, some pectine. The failure of my seed-store prevented the completion of my investigation, which I hope to resume in the summer. The powdered seeds were first treated with ether, to remove fat; a green oil was thus obtained, which solidified after standing a few days in a cool spot. This was separated into a liquid and a solid fat by pressure between two folds of bibulous paper. The liquid oil was olcine; it readily saponified, and the lead salt prepared with it was soluble in ether. I did not further examine it. The solid fat was saponified by melting it with hydrate of potash: a clear solution was prepared, purified with chloride of sodium, and then decomposed with tartaric acid. The fat thus obtained solidified to a crystalline mass, and was of a dazzling white colour; it dissolved without difficulty in hot alcohol, and crystallized from it in large, nacreous, snowy-white laminæ. It was recrystallized for purification until the melting point remained constant at 86°. This could not be raised higher by further crystallization. The acid was easily pulverulent, melted readily in the hand, and decomposed carbonate of soda with effervescence. The soda salt was dissolved in absolute alcohol, and precipitated with nitrate of silver: it yielded a beautiful white salt, which became coloured by exposure to the light. On analysis it furnished the following results:—I. 0.2500 grm. gave 0.0655 silver = 27.4 Ag. II. 0.4220 grm. gave 0.1160 silver = 27.64 Ag.

I was unable, from want of material, to make an elementary analysis. From the constancy of the melting point, and the appearance of the acid, I conclude that it is a distinct fatty acid. It may, however, have still contained oleic acid, and this may have lowered its melting point beyond its proper standard.

The seeds, previously exhausted with ether, were next boiled with alcohol, and then separated from it by straining and pressure. This operation was twice performed, and the alcoholic liquors were distilled. When one fourth of the

alcohol had passed over, suddenly there separated a substance in the mass, succussion quickly followed, and the liquid boiled over. An indistinct crystalline yellow substance came away on cooling—this was impure hederic acid. Hitherto I have been able to obtain this acid pure only in a flask containing a mixture of an alcoholic solution of hederic acid in ether, from which the acid separated in a pure state. On a second trial I succeeded to obtain it pure by this method. The following are its properties:—It crystallizes from alcohol in slender needles and laminæ of a dazzling white colour; the alcoholic solution has a faint acid reaction. It is insoluble in water and ether: the latter precipitates it from a concentrated alcoholic solution. It has no smell, and possesses the peculiar taste of the ivy-seed in a high degree. With bases it combines to form neutral salts; carbonic acid is expelled by it from its combinations. The salts are not to be obtained in a crystallized state; they form gelatinized compounds, most of which are insoluble in water, but soluble in alcohol. The ammonia and potash salts are scarcely soluble in water, and separate in the form of gelatinous precipitates without colour. The lime and baryta salts are insoluble in water, but dissolve in boiling alcohol; they also form gelatinous masses, which, on drying, become a white powder. The acid forms several combinations with oxide of lead, according as it is precipitated with a neutral or acid solution. The silver salt is white; it is prepared by precipitating hederate of ammonia from its alcoholic solution with nitrate of silver. It is soluble in alcohol, and may be boiled in it without danger of decomposition; it separates in the crystalline form on cooling. In the pure acid 5.4 per cent. water of crystallization is found, which is driven off at 212°. When heated it does not melt, but diffuses an empyreumatic odour peculiar to it, is entirely decomposed, and leaves a carbonaceous residue. Oil of vitriol dissolves it, and forms a splendid purple-red solution, which colour it retains for several days. I could not ascertain the atomic weight of this acid, the salts not having been obtained from a substance perfectly pure. The results obtained thus varied considerably. Hederic acid in the crude state is exceedingly difficult to purify, owing to the presence of a new acid in the seeds, which, although it differs greatly from the former in many of its properties, is retained with great tenacity. I will describe its properties as nearly I can, premising that I have not met with it in its pure state. It is soluble in water, alcohol, and ether. I procured a concentrated solution of it by proceeding as follows:—The seeds, which contain a large quantity of it, were exhausted with alcohol and ether; they were boiled in water, the solution was acidified with acetic acid, and precipitated with excess of basic acetate of lead. The precipitate was collected on a filter, and the solution mixed with ammonia; the impure lead salt was thus precipitated; it had a beautiful sulphur colour; it was collected on a filter and washed; its quantity thus suffered diminution; it was next formed into a paste with water, and decomposed with sulphuretted hydrogen. The solution filtered from the sulphuret of lead contains the impure acid; it did not crystallize on evaporation; the liquid became coloured from decomposition. The aqueous solution is void of colour, its taste and reaction are acid, and it is without smell. The following are some of its most characteristic reactions:—Its combinations with alkalis are all soluble in water, and have a fine yellow colour, which always indicates its presence. It is by virtue of its presence that the impure hederic acid dissolves in potash with the yellow colour, which pure hederic acid does not. It readily reduces oxide of silver and the protoxide of mercury when heated with these oxides in solution. Its precipitates with salts of baryta and lead, with chloride of calcium and ammonia, with bichloride of mercury and ammonia, are all yellow. It gives no precipitate with solution of gelatine, protosulphate of iron, or persalt of iron, but is coloured dark green by the latter. It furnishes a green precipitate with sulphate of copper.

The ease with which it is decomposed in the air, and its reaction with salts of iron, make it appear to belong to the astringent substances. The beautiful colour of its salts, at all events, establishes its title to further attention.—*Liebig's Annalen*, Jan., 1849.

ON THE PRESENCE OF COPPER IN THE HUMAN BLOOD.

By M. DESCHAMPS.

The question of the presence of copper in the human blood has hitherto been a subject of lively controversy. A great many experiments have been made to establish or to disprove the existence of that metal in organic bodies. Most of these experiments or the reports of them are, or seem, however, defective in some important point or other, which greatly detracts from the conclusiveness of their results. Thus, for instance, some of the experimenters omit all detailed description of the analytical process, and content themselves with the bare statement of the results of their researches; others would seem to have neglected to examine the precipitate produced in the liquid under examination by sulphuretted hydrogen (whether in the gaseous or liquid state), or they omit to state how long the liquid was permitted to stand at rest, after the addition or transmission of the hydrosulphuric acid, in order to allow the deposition of the precipitate formed; others still forget to tell us whether the distilled water and the acids (more particularly the hydrochloric) used in the analytical processes had been prepared in their own laboratories or procured in the market, which is a matter of very great importance, considering that even the *purest* hydrochloric acid of commerce contains almost invariably copper.

M. Deschamps, after examining the various processes proposed to effect the detection of metallic substances in the blood, resolved to follow an analogous method to that adopted by him to extract copper from plants.

He prepared in his own laboratory the acids and the distilled water required for the analytical processes, and ascertained that they were chemically pure. The filters were made of paper perfectly free from the slightest trace of copper, and were washed with a mixture in equal proportions of concentrated nitric acid and distilled water. The capsules, crucibles, glass rods, bottles, funnels, and glasses were carefully washed with aqua regia or concentrated nitric acid, and in some instances with boiling concentrated nitric acid.

The experiments were made respectively with 162, 200, 300, 315, 380, 472 grammes of blood. The blood was cautiously evaporated to dryness in a porcelain capsule, and then incinerated in a porcelain crucible. The ash was treated with aqua regia or concentrated nitric acid. The solution obtained was evaporated to remove the greater part of the acid; water was then added to the residuary liquid, and the mixture filtered into a bottle. Sulphuretted hydrogen gas was now transmitted through it, and it was then left standing at rest for from eighteen to twenty-four hours, to give the precipitate formed full time to subside. The liquid was filtered and the precipitate collected on the filter. The filter, with the precipitate on it, was washed, in a small procelain capsule, with water holding a little sulphuretted hydrogen in solution; it was then treated with a few drops of aqua regia or concentrated nitric acid, and gently heated until the precipitate had acquired a light yellow colour, like sulphur, when the filter was washed, the liquid evaporated to dryness, the residue calcined, and, finally, dissolved in a few drops of nitric acid. The solution presented the properties of a solution of a copper salt; it struck a blue tint with ammonia, gave a reddish-brown precipitate with ferrocyanide of potassium, and, which was most conclusive, deposited metallic copper on iron.

These facts, M. Deschamps contends, irrefutably prove the presence of copper in the blood. In his opinion, plants take from the soil part of the copper which they contain, herbivorous animals receive that metal from the plants, and man from the plants and animals which serve him for food.—*Journal de Physique et de Chimie*, December, 1848.

CALIFORNIA.—THE PROPERTIES OF GOLD.

In colour and lustre inexperienced persons might mistake various substances for gold; these are chiefly iron and copper pyrites, but from them it may be readily distinguished, being softer than steel and very malleable; whereas iron pyrites is harder than steel, and copper pyrites is not malleable; for, although the latter mineral yields easily to the point of a knife, it crumbles when we attempt to cut or hammer it; whereas gold may be separated in thin slices, or beaten out into thin plates by the hammer. There can thus be no possible difficulty in distinguishing these various minerals in a native state, even with nothing but an ordinary steel knife. From any other minerals, as mica, whose presence has also misled some persons, gold is easily known by very simple experiments with a pair of scales, or even by careful washing with water, for gold, being much heavier than any other substance found with it (except platina and one or two extremely rare metals), will always fall first to the bottom if shaken in water with mud, while mica will generally be the last material to fall. This is the case however fine or few the particles of either mineral may be.

Gold, therefore, can be distinguished by its relative weight or specific gravity, and by its relative hardness, from other bodies which resemble it. It is described generally as soft, completely malleable and flexible, but more accurately as softer than iron, copper, or silver, but harder than tin and lead. It is useful to know facts of this kind, as a simple experiment that can be made with instruments at hand is often more valuable than a much more accurate examination requiring materials not immediately available. Thus, if it is found that a specimen (perhaps a small scale or spangle) is readily scratched by silver, copper, or iron, and scratches tin and lead, it may, if of the right colour and sinking rapidly in water. be fairly assumed to be gold.

The weight of gold, as of all substances, it is convenient to estimate relatively, and in comparison with the weight of an equal volume of water. The relative weight, or specific gravity, as it is called, of gold is remarkably high, the lightest varieties being twelve times heavier than water, and pure gold nineteen times. This is expressed by saying that the specific gravity of native gold is 12—19, and the number determined by comparing the weight of the mineral in water and air.

As the value of gold depends almost entirely on its specific gravity, and this test, therefore, is of the greatest practical importance, it will not be out of place if we here explain some very simple apparatus for the determination of this point.

If the specimen, then, is large enough to be suspended conveniently by a thread, weigh it first in air by a fine balance, expressing the result in grains, and taking care previously to remove dust or loosely adhering particles. Then suspend it by a horsehair from the scalepan (it is convenient to have a hook attached to it for this purpose), and, thus suspended, immerse it and reweigh it in water, taking care that it is covered on all sides by at least half an inch of water, and carefully brushing off with a feather any bubbles of air that adhere to the surface. The results may then be noted as follows:—

Weight of substance in the air in grains .. ..
Deduct weight of ditto in water

Difference .....

This result gives the weight of a bulk of water equal to that of the specimen, and by dividing the weight of the specimen in air by this number the specific gravity is obtained.

$$\text{Specific gravity} = \frac{\text{weight of substance in air.}}{\text{weight of equal bulk of water.}}$$

If, however, the substance is in the form of fine sand or very small lumps, it is better, after weighing it carefully, to take a small dry phial furnished with a stopper; counterpoise this phial accurately in the weight-scale by shot or strips of lead, then fill it completely with pure water, taking care that no bubbles of air are left in, and weigh the quantity of water it contains: afterwards empty the bottle and dry it inside.

Next fill the bottle about two thirds full of the powder to be examined, weigh this, and record the weight. Then fill the bottle once more with water, taking care, as before, that all bubbles are expelled and none of the powder washed out. Once more weigh it.

We have then to make the following calculation:—

Weight of powder and water in grains ..... =
Deduct weight of powder alone =

Difference (weight of water left in bottle) .. =

Weight of bottle full of water in grains ..... =
Weight of water left in bottle =

Difference (weight of water displaced by, and equal in bulk to, powder) ..... =

$$\text{The specific gravity} = \frac{\text{weight of powder in air.}}{\text{weight of water displaced.}}$$

It may be useful to know the specific gravity of various substances at all resembling gold either in weight or appearance, and we therefore append the following short table. The specific gravity of water is assumed to be unity:—

Osmium	$21\frac{1}{5}$
Platinum	$19\frac{1}{2}$—22, not hammered.*
Iridium	$18\frac{7}{10}$
Gold	$15\frac{3}{4}$—$19\frac{1}{4}$ ditto.
Mercury	$13\frac{1}{2}$
Palladium	$11\frac{7}{10}$
Lead	$11\frac{1}{4}$
Rhodium	$10\frac{3}{5}$
Silver	10
Copper	$7\frac{3}{4}$—8
Brass	$8\frac{1}{2}$
Lead ore (galena)	$7\frac{1}{2}$
Copper pyrites	5
Iron pyrites	4
Diamond	$3\frac{1}{2}$
Sand	$2\frac{3}{5}$—3

By the help of this table the value of auriferous sand may also be in some degree estimated, since, as will be seen, the specific gravity of most of the sands is under 3, while that of the most impure gold is 12; so that if the specific gravity of the sands themselves, when experimented on, is much greater than that of ordinary sand, it is likely that the excess will be for the most part gold in a district otherwise known to be auriferous: the greater the specific gravity, too, the greater probability there is of this being the cause.

The form in which gold is found is various. It is sometimes crystilline in eight or twelve sided regular figures, passing into cubes, but the crystals are generally small and rare. In case of such crystals being found, it is well worth knowing that they possess a value as mineral specimens far beyond that of the gold which they contain.

The gold from California, according to the assay of Mr. Warwick, of New York, yields 89.58 per cent. pure gold, and is, therefore, about equal to that obtained from the washings of Miask (the richest district in Western Siberia, and that producing the largest pepipas), and superior, as the assayer remarks, to the gold dust from Senegal.

The method of blowpipe analysis, although exceedingly useful, is not absolutely necessary in the case of gold, because of the many readier ways of determining the metal, but it seems advisable to state the appearances presented. All the varieties are readily fusible into a globule, which, when the gold is pure, is unaltered by the continuance of the heat. In this respect it differs entirely from iron and copper pyrites, which, on being exposed to the flame, give off sulphur fumes and undergo considerable change. In the case of gold containing other metals, these, with the exception of silver, may generally be got rid of by continuing the heat in the exterior flame with the addition of a little nitre. Before the oxyhydrogen blowpipe the metal is volatilized in the form of a purple oxide.

Gold is not acted on by any of the acids alone. When exposed to the mixture of nitric with hydrochloric acid (in the proportion of one part nitric to four of hydrochloric) called aqua regia, it dissolves without residue, the solution giving a purple precipitate with protochloride of tin, and a brown precipitate with protosulphate of iron.

The following simple mode of detecting attempts at imposition in gold dust is worthy of being recorded in this place:—

Place a little gold dust in a glass tube or earthenware saucer, and pour nitric acid upon it; then hold the glass or saucer over a flame, or upon a few embers, until red fumes (nitric vapours) arise; if it be pure gold, the liquid will not become discoloured; but if pyrites or brass filings should have been mixed with it, the acid will become turbid, green and black, discharging bubbles of gas. After the ebullition has ceased, the residue should be washed with water, and acid again poured upon it, when the same effect may be observed, but in a less degree; and, if the experiment be repeated till all effervescence ceases, it will finally leave the gold dust pure.—*Professor Anstey's Gold-seekers' Manual.*

* Metals when hammered become much more compact, and have, therefore, a higher specific gravity.

THE CHEMICAL TIMES.

SATURDAY, MARCH 3, 1849.

THE SMITHFIELD-MARKET NUISANCE.

WERE any further proof needed to establish the fact that Smithfield Market is, indeed, one of the greatest and most abominable nuisances, we might find a convincing one in the more than wretched attempt at a defence set up by the advocates for its continuance. Seldom, indeed, does it happen that even the worst and most rotten causes do not find some skilful defender, who, though he may be unable to *beat*, yet will manage to *embarrass* his antagonist. Smithfield Market does not rejoice in defenders of this stamp. Messrs. Hicks, Godson, Anderton, Lawrence, and their adherents, seem altogether unable to advance even the weakest argument in favour of the cause which they have undertaken to defend. They content themselves with giving flat denials to the most irrefutably-established *facts* adduced by the advocates for the removal of the market, or try to explain them away. In the opinion of these gentlemen, Smithfield is one of the healthiest localities in London; and we are very complacently told that Mr. Lawrence, the surgeon, and another high authority, have pronounced it to be so. How many equally high authorities have chosen to differ from this opinion, and to hold that nothing can possibly be more injurious to the health of a considerable part of the metropolis than the existence, in a central point, of a large cattle market, with its attendant slaughter-houses, we are not told: possibly the balance of authority might be rather too strong the other way. The circumstance that Bartholomew's Hospital and the Charter-house are situated in the immediate vicinity of the market is actually laid hold of as a proof of the perfect salubrity of it! Absurdity can, indeed, go no further. Why, this is one of the most forcible pleas for the removal of the market. Inquire of any medical man of sense and experience whether he would ever dream of selecting a cattle market as a proper site for an hospital? or whether he would deem the question of site in this respect a matter of no, or of only trifling, importance for the treatment and chances of recovery of the patients received at the hospital? We maintain that the immediate vicinity of the market must of necessity exercise an unfavourable influence upon the inmates of Bartholomew's Hospital, which, though perhaps not appreciable by those who, from early association and constant habit, have grown accustomed to the close contiguity of the market to the hospital, and may even look upon it now as a necessary appendage to the latter, yet cannot fail to strike the most casual impartial observer.

One would hardly think any man or body of men should seriously believe it possible to continue for any length of time cramming into a space which was hardly large enough to serve the purposes of a cattle market for a population of 500,000 souls the number of cattle required to feed a population of 2,500,000 souls, and which is constantly increasing at a formidable rate. And yet such seems to be the opinion of the corporation of the City, who, through the mouth of one of their champions, tell the public with the most admirable *sang-froid* that the market shall remain where it is as long as the Legislature of the country will permit its continuance. And when the advocates for its removal urge, amongst other and most weighty reasons, the misery which the poor cattle are made to undergo, and point out the bad effects upon the quality of the meat, that must necessary result from the horrid ordeal of being forced into, and cooped up in, spaces far too small for proper accommodation which the animals have to pass through, they are called, forsooth, *philanthropists* by Mr. Anderton, and are charged with an interested desire to become shareholders in some scheme for the erection of a new cattle-market in another locality. Or Mr. Hicks comes down upon them with the high and weighty authority of "Sir Charles Knightley, who has given his unqualified opposition to any proposition of abolishing the market." Pray, Mr. Hicks, who is Sir Charles Knightley, that you should deem his opposition of such vast importance? Sir Charles Knightley may be "the first grazier in England," and a man of considerable influence in Northamptonshire; but we cannot for the life of us imagine how his opinion, either one way or the other, can affect the question more strongly than that of any other

individual; and we would even presume to suggest to Mr. Hicks and his friends that the question of the removal or continuance of Smithfield Market is entirely one for the consideration of the inhabitants of London, and not for the *opinions* of the "graziers of England."

The gentleman who distinguished himself most in the Common Council tilting match against the advocates for the removal of Smithfield Market was, unquestionably, Alderman Lawrence. From the *very peculiar* nature of the pleading which that worshipful alderman thought proper to utter, it was clearly apparent that his brief had been endorsed "no cause—abuse plaintiff's attorney;" for that worthy civic dignitary set to and made a most formidable onslaught on the press, charging the whole body of the London journals with venality, by which charge he apparently meant to convey his impression that Smithfield Market is the intended victim of some huge conspiracy, and that the whole of the London press have been bribed to attack it in their columns. This worthy magistrate, who evinced his strict adherence to truth in a passing remark, that Lord Robert Grosvenor "*broke completely down*" in his evidence before the parliamentary committee upon the subject of Smithfield Market, which sat in 1847, accuses the press of being in the habit to concoct and insert slanderous attacks upon individuals, for the purpose of selling their productions. Comment upon remarks like these would be altogether superfluous.

We cannot conclude this article without paying Mr. Norris, the mover of the resolution demanding the removal of the market, a well-deserved compliment for the clearness and precision with which he put his case before the court.

THE CHOLERA.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
Cases already reported:—				
In London and vicinity...	1133	584	135	414
In the country	958	413	152	393
In Scotland	11244	4895	3864	2485
Total	13335	5892	4151	3292

Fresh cases reported the 28th of February, 1849.—In London and vicinity, viz.:—Whitechapel—number of cases, 1; deaths, 3. Bethnal-green Lunatic Asylum—number of cases, 2. Hoxton—number of cases, 1; death, 1. Refuge, Hackney-road—deaths, 2. Dreadnought Hospital Ship—number of cases, 1; death, 1.

In the country, viz.:—Newcastle-upon-Tyne Union from the 20th inst.—number of cases, 11; deaths, 4; recoveries, 6. Wakefield—recoveries, 2. Carlisle—number of cases, 2; deaths, 2.

In Scotland, viz.:—Glasgow—number of cases, 12; deaths, 4; recoveries, 12. Riccarton—number of cases, 13; deaths, 3; recoveries, 10. Greenock—number of cases, 1; death, 1; recovery, 1. Galashiels—number of cases, 1; recoveries, 3. Dunfermline—number of cases, 3. Girvan, from the 13th inst.—number of cases, 21; deaths, 19; recoveries, 6.

Total number of new cases, 69; deaths, 40; recoveries, 44.

BIRTHS AND DEATHS REGISTERED IN LONDON.

The total number of deaths from all causes in London during the week ending Saturday last, according to the account published by authority of the Registrar-General, amounted to 1,191, being 22 beyond the weekly average of the years 1844-5-6-7 and 8. The deaths from zymotic diseases were 212, being 9 below the average; tubercular diseases, 174; of the brain, spinal marrow, nerves, and senses, 132; of the lungs, 239; scarlatina, 50; hooping cough, 76; cholera, 40, being 36 above the average; typhus, 53, being 11 below the average; consumption, 123, being 25 below the average; bronchitis, 118, being 40 above the average; pneumonia, 88, being 15 below the average. The births during the same week were 1,490, or 735 males and 755 females. The deaths show a small decrease on the previous week. The barometer was highest on Sunday week, having been 30.333, and lowest on Saturday, when it fell to 29.520. The mean temperature of the week was 45° 4′. The following is a specific statement of the deaths from cholera during the same week:—

Holborn; St. George the Martyr.—M. 13, "cholera (3 days)."

West London; North.—At union-house, West-street, a labourer, 40, "cholera."

Shoreditch; St. Leonard's.—At 4, Hudson's-court, Kingsland-road, on the 19th of February, wife of a shoemaker, 41, "cholera (8 hours)." Mr. Yarrow, the registrar, states that "this is a very unhealthy court. The deceased, who was in poor and distressed circumstances, had a miscarriage at Christmas, and seven days afterwards undertook a day's charing at a butcher's shop adjoining. She was then taken ill, and confined for three weeks, at the end of which time cholera supervened." The ten following cases occurred in the Female Refuge for the Destitute:—On the 18th of February, F. servant, 14, "Asiatic cholera (4 days);" on the 18th of February, F. servant, 18, "Asiatic cholera (3 days);" on the 18th of February, F. matron, 40, "diarrhœa (10 hours), Asiatic cholera (12 hours);" on the 18th of February, F. servant, 17, "Asiatic cholera (40 hours);" on the 20th of February, F. servant, 22, "cholera (48 hours);" on the 20th of February, F. temporary matron, 36, "cholera (24 hours);" on the 20th of February, daughter of a labourer in the county of Devon, 11, "Asiatic cholera (30 hours), disease of the chest (duration unknown)." On the 21st of February, F. servant, 24, "Asiatic cholera (3 days), secondary fever (5 days)." On the 22d of February, F. servant, 25, "Asiatic cholera (3 days)." On the 23d of February, F. servant, 14, "natural death from Asiatic cholera," inquest.

Bethnal-green; The Green.—The sixteen following cases occurred in Messrs. Warburton's Lunatic Asylum:—F. 55, "mania (15 years), diarrhœa (6 hours), cholera (8 hours);" F. 45, "cholera, collapse (14 hours);" F. 40, "mania, cholera (13 hours);" F. 52, "mania, cholera (15 hours);" F. 39, "mania, diarrhœa (6 hours), cholera (18 hours);" F. 70, "mania, cholera (11 hours);" F. 85, "mania, cholera (14 hours);" F. 48, "diarrhœa (4 hours), cholera (15 hours);" F. 48, "mania, cholera (23 hours);" F. 26, "idiotcy, cholera (10 hours);" F. 40, "mania, diarrhœa (11 hours), cholera (19 hours);" F. 38, "mania, cholera (8½ hours);" F. 30, "mania, cholera (24 hours);" F. 35, "epilepsy, cholera (72 hours);" F. 70, "mania, cholera (3 days);" F. 49, "mania, cholera (88 hours)." Hackney-road.—At 18, Clare-street, cheesemonger, out of business, 49, "diarrhœa (3 days); malignant cholera with collapse (2 days)." Mr. Murray, the registrar, states that "deceased was in reduced circumstances, and suffered under distress of mind and lowness of vital energy."

Whitechapel; Whitechapel, North.—At Wellington-street, on the 8th ult., son of a respectable labourer, 21 months, "natural death; sudden from Asiatic cholera," inquest. The two girls who follow belonged to one family not long from Ireland; the younger died on the 9th, the other on the 10th, in Queen Anne-street. F. 2, "sudden death of cholera (12 hours)," inquest. F. 5, "sudden death of cholera (12 hours)," inquest.

St. George's-in-the-East; St. Paul.—A coalwhipper, 45, "consecutive fever (5 days), cholera maligna (2 days)." M. 67, "cholera (24 hours)." The deceased was a pauper removed from the workhouse to 3, Bath-terrace, New-road, which was lately taken for cholera patients. St. John.—At St. George's workhouse, a mariner, 49, "cholera."

Camberwell; Peckham.—Daughter of a labourer, 3, residing at No. 2, Maria-terrace, Peckham-fields, "diarrhœa (2 days), Asiatic cholera (3 hours)."

Rotherhithe; Rotherhithe.—M. 5, "cholera (7½ hours)."

Greenwich; Greenwich, West.—In Dreadnought Hospital, M. 16, "cholera (8 days)," p.m.

Wandsworth and Clapham; Battersea.—At Bridge-road, son of a warehouseman, 15, "malignant cholera (4 days)."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Joseph Simpson, of Manchester, civil engineer, and James Alfred Shipton, of the same place, engineer, for certain improvements in steam-engines. Patent dated August 14th, 1848. Enrolled February 14th, 1849.

This invention relates first to an improved construction of steam-engine, by which the motion of the piston is transmitted to the crank-shaft in such manner that the angles formed by the connections in reciprocating engines are totally avoided, and, consequently, without the loss of power by friction arising from such causes.

The details of this part we must, in a great measure, omit, since they would be unintelligible without the drawings accompanying the specification.

The patentee claims also an improvement in the slide-valve which serves to admit the steam alternately at opposite ends of the cylinder. This valve is on the equilibrium principle, and the improvement consists in the introduction of a peculiar sort of packing-ring. The slide is fitted between two faces, on which it slides, the one being the face on the cylinder, and the other at the back of the valve-case, where it is furnished with a ring, cut on one side similar to the packing ring of a piston; its tendency to expand in diameter also causes it, by reason of its conical form, to press against the back of the valve-chest, thereby making it steam-tight, and allowing for any wear that takes place on the surfaces. The opening in the ring is provided with small wedge pieces, which prevent the passage of the steam, and may also assist in expanding the ring by the pressure of the spring with which it is projected.

In order to maintain perfect contact at each end of the piston with the ends of the cylinder, each end of the piston is fitted with a packing-ring, of a similar construction to that just described with reference to the slide-valve; the conical form of these rings causing them as they expand also to elongate the piston, and thereby press hard, or with sufficient force to maintain steam-tight joints at either end of the cylinder with which they are in contact. These rings must, of course, be of sufficient diameter to embrace the whole of the slot, at any point of the revolution of the piston, in order to prevent any escape of steam, by which also the eccentricity of the piston with its shaft will be limited.

The second part of this invention relates to an improved governor or regulator for steam-engines, which consists of a spiral screw similar to that employed for propelling vessels, but comprises more than a whole turn of the thread or

screw. The axis is placed in a vertical position, and the whole of the screw enclosed within a cylinder, which is partially filled with water, or some other suitable fluid, the cylinder itself being placed within a vase, or other ornamental casing, into which the bottom of the cylinder opens. The axis of the tube, which passes out at the bottom, where it receives motion from a pair of mitre-wheels, is enclosed within the cylinder by a tube rising up from the bottom of the vase above the surface of the water, which permits the passage of the spindle without a stuffing-box or other hindrance to its action. The screw is fitted to its axis or spindle by a boss, which slides freely up and down on a feather, which at the same time carries it round with it. A spiral spring is placed between the upper bearing and the boss of the screw, and continually exerts a downward pressure thereon. Motion is given to the screw by the engine, which imparts a tendency to rise in the water; this is in a great measure counteracted by the spiral spring, and at any given velocity will attain a neutral point or equilibrium between the two powers; any greater or less velocity causing either a rise or depression of the screw. A loose hoop on the upper part of the boss imparts motion to a lever, by which it is transmitted to the throttle-valve or other regulator, in a similar manner to the ordinary governor. The water in the cylinder will to a certain extent be carried round with the screw; but, in order to prevent this, a series of plates are placed in a vertical position in the bottom of the vase, radiating from the centre and rising nearly to the lower end of the screw.

The third part refers to an arrangement or combination of valves, for cutting off and otherwise regulating the passage of steam, through tubes, to the engine. This consists simply in combining the ordinary slide-valve with a butterfly throttle-valve, which is fitted in the back part of the slide-valve; this is of sufficient area on the face to admit of the passage being cut through it, and at the same time to close completely the steam-passage when moved to another position. The stem of the slide-valve is furnished with a screw, on which the boss of a hand-wheel is fitted; and, this being confined between bracket bearings, the slide-valve is withdrawn or replaced opposite the steam-passage by turning the same. The stem of the butterfly-valve passes up the stem of the slide-valve, which is furnished with a stuffing-box at the top, to prevent the escape of steam, and is actuated by the governor in the ordinary manner; producing the same result by partially closing the steam-passage, but which in this case is in the slide-valve, instead of being situate in another part of the passage or steam-pipe. The slide-valve must of course be sufficiently thick to admit of the butterfly-valve being fitted to it, or it may have a short tube cast on the back in which it is fitted, and which, if sufficiently well fitted, would entirely cut off the steam without altering the position of the slide; which, however, is used in the manner described in the claims.

The patentees do not confine themselves to the precise details given, as such may be varied without departing from the peculiar character of their invention; they claim:—

First. The mode described in the specification, but omitted here for the reason stated, of constructing engines working with eccentric pistons, whereby an eccentric piston is caused to reciprocate with a steam-chamber, the width of which is equal to the diameter of the eccentric piston; the axis of which eccentric piston being caused to move a distance equal to the eccentricity of the piston.

Secondly. The means of packing slide-valves, by employing bevilled rings, as described.

Thirdly. The constructing and using of a revolving spiral screw, enclosed in a cylinder containing water or some other fluid, and applied to the purpose of governing steam-engines, by acting on the throttle-valve, or other equivalent apparatus.

Fourthly. The mode of constructing a sliding shut-off valve, containing a butterfly throttle-valve, fitted into the back or middle of such slide-valve, and worked by a second spindle passing through the main spindle, having a stuffing-box at the end, or passing through any other part of the valve-chest to the outer surface.

Also the use of the stop shut-off valve, or regulator, being provided with a first part, for regulating the size of the steam-passage; and having at the same time a second part for finally shutting off the steam or other fluid working the engine.

Also the arrangement (of any kind of valves) of having the seating or face joint protected from the ravages of the volume of steam that passes through the said valve, whether the said valve be partially or fully open; that is, by having one part of the valve for regulating the quantity, and a second part for finally closing the passage, so that the latter is shielded from the former when such valve is open.

John Varley, of Bury, in the county of Lancaster, engineer, for certain improvements in steam-engines. Patent dated August 14th, 1848. Enrolled February 14th, 1849.

This invention relates to improvements applicable to stationary engines—that is to say, engines whose cylinders do not oscillate—and which consist in the adaptation of the steam and exhaust valves to the cover and bottom of the cylinder, so as to open directly into the cylinder, thereby dispensing with the passage ordinarily leading between the valves and the interior of the cylinder, which give rise to a great waste of steam at each stroke of the engine, besides interfering with the due expansion of the steam, when worked expansively; the patentee maintains, moreover, that this construction (whether equilibrium or stalk valves) of the valves is a great saving in the first cost of the engine, from the absence of the slide and faces on the cylinder. Cavities are formed in the cover and bottom of the cylinder, or in raised boxes cast thereon, in which the valves are placed, two being fitted to either end, one for the entrance, and the other for the exit, of the steam. The valves shown in the drawing which accompanies the specification are double conical valves, the stem of which passes through a stuffing-box in the cover, for the purpose of actuating the same. In the cylinder cover the lower seating is fitted immediately into the thickness of metal next the interior, so that the lower valve, when down, forms part of the under surface of the cover; the other part of the valve on the same stalk or spindle is higher up, by the depth of the steam-passage, which enters between them. The exit-valves are similarly constructed, each being respectively connected with the steam-pipe and passage to the atmosphere or condenser. These passages are cast in opposite sides of the cylinder, running from end to end, and communicating with the steam and eduction valves, at either end of the cylinder, both ends being similarly furnished—one of these passages being connected with the boiler, the other with the condenser. Small passages lead from the cylinder above the valves, so as to maintain their upper and under surfaces in equilibrium. The valves are actuated by means of a rotating horizontal disc, placed below the cylinder, having a cam on its surface, at the circumference, on which a roller runs, supported from one end of a lever; the other end being connected with the stalk of the induction-valve. A similar roller is in connection with a rod passing up the side of the cylinder from which an arm takes on to the stem of the upper induction-valve. The eduction-valves are similarly actuated by a cam on another shaft; the whole being, of course, arranged to open and close their respective valves at the proper time, whether for working steam expansively or otherwise. The different cams are worked by suitable gearing with the main shaft, and will not require particular description.

Having described the nature of his invention, and the manner of carrying it into effect, the patentee wishes it to be understood that what he claims is—the novel and peculiar method, before described, of placing the steam and exhaust valves of steam-engines (either equilibrium or stalk valves) in the cover and bottom of the cylinders, thereby avoiding passages between the valves and the cylinder; and also the mode of working the same.

Thomas Delarue, of Bunhill-row, in the county of Middlesex, manufacturer, for improvements in producing ornamental surfaces to paper and other substances. Patent dated August 15th, 1848. Enrolled February 15th, 1849.

The improvements in the production of ornamental surfaces, described in this specification, consist in forming upon the surfaces of paper and other substances iridescent films of certain substances. It is well known that a piece of steel will, at various degrees of temperature below a red heat, assume various degrees of colours, dependent upon the degree of heat. This is caused by an exceedingly thin film of oxide which forms upon the surface of the steel. Common soap bubbles, when very thin, exhibit also a variety of colours. Globules of glass, blown very thin, also sometimes present the same appearance.

The present improvements are to produce the same appearance of a variety of colours upon the plain or ornamented surfaces of paper and other substances, and the process proposed to be followed for effecting this is as follows:—A vessel is procured, of sufficient capacity, to contain the article the surface of which is to be treated; the depth of the vessel, however, should be sufficient to allow a few inches above the article, when placed within it. Within this vessel a quantity of clean water is placed, and the article the surface of which is to be covered (as a sheet of enamelled cardboard, for example) is then placed within the vessel in the water, the surface which is to be covered being placed upwards, and care is to be taken that the quantity of water in the vessel is sufficient to cover the article completely when the surface of the water is in a quiescent state; the surface of the water is then covered with a thin layer of varnish (composed of any of the resins, dissolved in ether, or any convenient solvent), or of any other fluid or semifluid substance capable of depositing a solid matter, and imparting the colours required. When the varnish or other material used is fully spread over the surface of the water, the sheet of cardboard is to be gently lifted out of the water, in a slightly inclined position, by which means a thin film of the varnish will be taken up by, and spread over, the surface of the cardboard, the water passing off from between the cardboard and the film of varnish. The cardboard is then to be laid in an inclined position upon a board, and when dry it will be found that there is a thin film of varnish over its whole upper surface; it is then removed and finished. This film will present various colours. The patentee proposes to use, in some cases, a false bottom, perforated with holes, upon which the article operated upon is placed; the bottom, with the article upon it, being removed from the vessel when necessary. In the case of figures, or other articles which require to be covered over the whole surface, the article is suspended by wires in the water, and in drawing it out it is gradually turned round, so that the whole surface thus becomes covered with the film. On the dropping of the varnish upon the surface of the water, it speads itself in a series of rings around the centre of the drop, as a nucleus, and thus, by a combination of these drops and rings, a variety of beautiful designs are formed. Also, by means of a brush over portions of the surface, other designs are formed, which are transferred to the surface of the article. Thus, by the application of films of varnish, &c., in themselves colourless, colours are produced upon the surfaces of paper and other substances; bright metallic surfaces, however, present little or no colour, but black japanned surfaces exhibit them very beautifully. Plaster casts or figures may also be subjected to the same process with

advantage, by previously treating the surface with wax.

The patentee claims, generally, the producing films upon the surfaces of paper and other substances, as before described.

Samuel Thornton, of Birmingham, merchant, and James M'Connell, of Wolverton, Buckinghamshire, engineer, for improvements in steam-engines, and in the means of retarding engines and carriages on railways, and in connecting railway carriages or waggons together; also improvements in effecting a communication between one part of a railway train and another, by signals or otherwise. Patent dated August 7th, 1848. Enrolled February 7th, 1849.

This invention has reference—first, to improvements in metallic-packed pistons. Secondly, to improvement in the chimneys, for the purpose of obtaining an increased effect upon the blast. Thirdly, to an improved construction and arrangement of the eduction passages and valves. Fourthly, to an improved mode of connecting railway carriages together. Fifthly, to an improved arrangement of the buffer-rods, by which they are all retained at the same height from the rail, whatever may be the load of the carriage. Sixthly, to a method of transmitting signals from one part of the train to another by means of chains or ropes passing through hollow buffer-rods, which are also applicable for actuating the whole breaks throughout the train for the purpose of retarding it when required.

In metallic-packed pistons it is of great consequence to obtain as near as possible a uniform degree of wear on the piston, as it is otherwise liable to rut, which is more or less the case with pistons of the ordinary construction, from the expanding pressure bearing unequally at different points, consequently creating a greater amount of friction on one part than another. The piston constructed according to this invention consists of the ordinary annular packing-rings, cut or divided at two opposite or more points, so as to admit of their being expanded to fit the internal capacity of the cylinder; the division in the one ring being, of course, placed so as to break joint with the other ring; and both are held by the top and bottom plates, as usual. The packing-rings or segments are furnished with a rib at the back, turned out conical, into which conical rings are fitted. These rings are left solid, and have a recess turned out in the back part for the reception of a thin disc of steel, hardened for the purpose of giving the required degree of elasticity. Between the steel discs a strong metal spring is placed, which encircles the piston-rod, and bears on both the discs, exerting its pressure to force them asunder; and these discs bear upon the conical rings, the conical peripheries of which tend to expand the packing-rings, and the rings being solid must always bear equally throughout the entire circle, the conical ring passing farther on through the rib, as the packing-ring wears.

The second improvement, which refers to the construction of locomotive chimneys, consists in subdividing the chimney in several shafts, each having its separate blast-pipe. It is well known that all locomotive chimneys are subject to certain restrictions in their height from the height of the bridges and tunnels which are passed under; and that the blast-pipe, from whatever sized cylinder, is in such proportion that it will eject all the air out of the funnel in order to produce the required draught. Now, when a large chimney and a great draught are required, the height to which the chimney is restricted by local circumstances renders it incompatible with the result desired. To obviate this difficulty, and obtain a greater advantage of draught, the patentees subdivide the chimney into three or more separate shafts, all communicating with the smoke-box, but each furnished with a separate jet or blast of steam branching from the eduction-pipe of the engine, which will be simply in effect two, three, or more small chimneys instead of one large one. These three shafts are enclosed in an outer casing or chimney to protect the whole, giving it the appearance of the ordinary funnel.

The third part relates to an improved arrangement in the eduction passages and valves of locomotive engines, in order to effect a reduction in the back pressure, by making these passages more direct to the blast-pipe than hitherto. In the ordinary arrangement the exit steam has to retrace the steam-ports passing through the internal capacity of the slide-valve, and thence through the eduction-passage to the blast-pipe, which circuitous route materially augments the back pressure consequent on the escape of the steam at the blast. In order to obviate this, the patentees carry a passage direct through from the ports in the cylinder to the facing; the short slide and steam passages remaining as usual, the new exit-passages being in addition to the old. Between the cylinder face and a faced surface on the inside of the valve-jacket additional valves are fitted, having passages through them which coincide with the new eduction-passages, forming a direct communication from the cylinder to the tubes leading to the chimney. These additional valves are worked by the same valve-rod as the short slide, the action of the whole being simultaneous—the auxiliary valve at one end of the cylinder closing the direct communication while the steam is being admitted at that side of the piston, the valve opening the direct communication simultaneously with the opening of the eduction-passage through the short slide-valve, which, however, may be dispensed with if desired, the auxiliary valves always keeping the direct passages closed from the steam in the valve-jacket, and at all times except during the period for the eduction steam passing off.

The fourth improvement consists in the construction and arrangement of that part of the carriage connected with the buffer-rods, and by which the carriages may be brought together by the system of buffer frames or apparatus connected therewith. In the usual construction of railway carriages and waggons hitherto, it has been usual to connect the buffing apparatus with the framing of the carriage, so that the position of the buffer-rods assume a level or height above the rails according to the load to which the springs are subjected, and that, therefore, the whole buffer-rods of a train will be at variable heights, and not in the direct line so essential to their proper action. Instead, therefore, of placing the buffing apparatus in the framing of the carriage, it is affixed to, or in connection with, a frame directly attached to the axles, or on the axles themselves without other framework. By this means the whole may be arranged, and permanently remain at one uniform height from the rails throughout the train.

The fifth improvement consists in effecting a communication between one part of a railway train to another, by means of a chain or rope passing through the buffer-rods, which are made hollow for that purpose, preferring wrought iron tubing as a substitute for the buffer-rod, which, of course, must be sufficiently strong to resist concussion. In order to carry out this part of the invention, it is essentially necessary that the construction of buffer-rods should be on the principle before explained, in order to allow the free passage of the chain in the direction of the length of the train. This chain is conducted to the guards' van, placed in the front and rear of the train of carriages, where it is carried round a barrel or drum on the shaft of a wheel mounted in the van, and so arranged that its periphery can be forced hard down on the periphery of one of the running wheels, creating a sufficient amount of friction to draw the chain so as to produce a signal at the other end, which may be directly communicated to the engine-driver of the train. The friction wheel is represented as being near the fulcrum of a long lever, employed by the guard to produce the friction required; but various methods may be resorted to, such as screwing it hard down on the wheel, or by supporting it in a vertical frame fitted with screw apparatus for the purpose. The chains will, of course, be required to be connected at each carriage, which can be effected through slot-holes in the buffer-rods or heads; or short rods may be attached to the chains at that point to project from the buffer, by which their connection will be facilitated.

The last part refers to the application of this system of hollow buffer-rods and chains to the retarding of carriages, or, in other words, for applying the breaks to the wheels. This is effected by connecting the breaks with the short ends of vertical levers, the upper ends of which pass into the buffer-rods, and are furnished with toothed quadrants, into which the chain takes when pulled in one direction, so as to apply the friction produced by the contact of the wheels, before explained; the force will be thus transmitted to the break-levers, forcing the breaks with a corresponding amount of force against the periphery of the running wheels. Both breaks being usually between the two wheels of a carriage, it is necessary to reverse the order of break-levers alternately to obtain their simultaneous action by pulling the chain in one direction. The quadrants are constructed so that when the chain is released it shall slip over a plain part of the periphery after the breaks are sufficiently withdrawn.

The patentees do not confine themselves to the precise details, nor to the particular arrangements described, as the same may be considerably modified and varied according to circumstances, without departing from their invention.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING FEBRUARY 22, 1849.

Charles Thomas Pearce, Esq., of Park-road, Regent's-park, for improvements in apparatus for obtaining light by electric agency. Patent dated February 16th, 1849; six months.

Charles Frederick Whitworth, of Hull, gentleman, for improvements in preventing accidents on railways. Patent dated February 17th, 1849; six months.

John Bottomley, of Bradford, in the county of York, manufacturer, for improvements in machinery for weaving. Patent dated February 22d, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND FROM THE 20TH OF JANUARY, 1849, TO THE 20TH OF FEBRUARY, 1849.

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner, farmer, of Lyon's Wharf, Upper Fore-street, Lambeth, in the county of Surrey, for improvements in smelting copper. Sealed February 14th, 1849.

William Clay, of Clifton lodge, in the county of Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinders or rollers are used. Sealed February 14th, 1849

REMOVAL OF SMITHFIELD MARKET.

On Tuesday, Feb. 27, a Court of Common Council was held at Guildhall, in consequence of a requisition received by the Lord Mayor, for the purpose of considering the following motion:—

"That a market for the sale of live cattle in the midst of a city is incompatible with the convenience of persons resorting thither for the purposes of business; that the present market of Smithfield is insufficient in space as well as objectionable in situation; that the safety and health of the inhabitants demand its immediate removal; and that, therefore, a special ward committee be appointed to consider what steps shall be taken to remedy the existing evils, by providing a suitable market-place."

Mr. J. T. Norris, who moved this resolution, said that the question whether Smithfield should be appropriated for a cattle market was one of very considerable importance, inasmuch as it involved the honour of the corporation and the

interests of 2,000,000 or 3,000,000 of people. He would undertake to show the court that a neeessity existed for the removal of Smithfield Market, but in doing so he would not attempt to provide a remedy by pointing out the place where a cattle market should be held. He should leave to the eommittee of inquiry for which his motion asked the task of eollecting the information whereon they might come to a wise and prudent resolution. He would have done no more than his duty when he proved to their satisfaction that Smithfield Market was neither suitable to the purpose from the limits of its space nor from the eircumstanees of its situation, and that it was inconvenient to the trade and injurious to the health of the metropolis. Smithfield originated from Smoothfield, and was many centuries ago an open plain on the north-west side of the metropolis, occupying much the same relative position to it then as Hampstead-hill does to it now. On this field from time immemorial a cattle market was held. It was mentioned by Fitzgibbon to have been a cattle market long before the eommencement of the twelfth century, and it appears that even in those remote times it was a place for ordure and filth. Thus it was seen that their ancestors took care to have their eattle markets held in an open space of ground in the suburbs where there was an abundant supply of water and all the evils that had arisen in modern times were avoided. In 1614, by order of James I., Smithfield was covered over with a pavement for the first time, at a cost of £1,600. But so great had been the increase of the metropolis in size, and so vastly had the population increased, that the utility of the position once held by Smithfield had long ago eeased. That a space of ground adapted for the wants of a population of about 500,000 people should become quite inadequate as a cattle market for a population of more than 2,000,000 was only eonsistent with common sense, and must be obvious to the meanest capacity. Again, if it was proper that a market for 500,000 people should be situated away from the busy haunts of men, could it be right that one for 1,000,000 or 2,000,000 of people should be placed in the midst of the eity which they inhabited? Let them look at the effect which had been produced upon the property in the immediate neighbourhood. All over London the streets had been almost entirely rebuilt. The Mansion-house had been erected on the site of the old Poultry Market; the Custom house, the India-house, and the Bank were all modern erections. Streets of palaces had grown up, and Crooked-lane had vanished. Old London-bridge, with its turrets and houses, had given place to a new structure. The ehurch which contained the ashes of Sir William Walworth, and the Boar of East Cheap, had alike been swept away; but if they went into Smithfield there were still, in the surrounding districts, the gabled fronts of the houses, the narrow courts and dirty lanes, which existed there in the days of Elizabeth. But it was not from regard to the principle on which their ancestors acted that the corporation now defended the Smithfield Market, for long after the causes which made it eommendable had ceased they found men declaring that this place was the very apple of their eye. He showed that, as a commercial speculation, the thing was a failure, and that if the corporation had nothing better to depend on for its income it would soon be reduced to insolvency; then, when a point was made that the trade of a market did good to the vicinity, it was necessary to look the facts full in the face, and, having done so, he had yet to learn what the advantages thus derived really were. Round about the Royal Exehange and the Bank had grown up shops full of articles of luxury and rich merchandise, but Smithfield Market abounded only in gin-shops, the proportion there being one in five, while in other parts of the City it was only one in twenty-five. The hon. gentleman then proceeded, by reference to facts, to show the extent to which a eattle market at Smithfield interfered with the ordinary trade of the City, by obstructing the streets, terrifying the inhabitants, and giving facilities for thieving, double the number of thefts taking place there that occurred in any other part of the metropolis. He showed the injurious consequences upon the cattle themselves by crowding them in a narrow space and subjecting them to hardships which not only detracted from their quality, but exposed them to the greatest risks of contracting infeetious diseases from each other. By the existing system, the salesmen, about 170 in number, were principally benefited, while the graziers themselves had scarcely an opportunity of eoming into eontact with those who purchased their animals. The hon. gentleman referred to a report made by Mr. Seymour to the commissioners of sewers for the City and to the substance of a letter addressed by the surgeon of the City police to Mr. D. W. Harvey, as proving the injurious influence exercised by the market upon the health of the neighbourhood. In all questions of domestic importance, where the pollution of party did not enter, the opinion of the public press was a true indicator of the public mind; and it was a most singular fact that there was not a journal from the "Thunderer" down to *Punch* which had not a fact to tell, or truth to state, or an argument to present in favour of the abolition of Smithfield Market. The hon. gentleman concluded by calling on the court to accede to the terms of the resolution which he had moved.

Mr. White seconded the motion, going over nearly the same arguments as had been used by the previous speaker. Having referred at some length to the establishment of abattoirs at some distance out of Paris, he asked the court why, as all things had their day, Smithfield market should not have its too, now that the public voice required its abolition?

Mr. Hicks moved the previous question. The inconvenience said to arise to trade from the existenee of Smithfield Market would be the same wherever it was placed. He read a list of towns in England the markets of which were similarly placed, with the view of showing that the position of Smithfield Market was not anomalous. The misery and wretchedness which existed in the neighbourhood had nothing to do, he contended, with the market, and should, therefore, be dismissed from the subject under consideration. He complained that, as the situation of the present market had been objected to, no attempt had been made to indicate the locality where it ought to be held, and, on this head, he entered into minute details for the purpose of showing that any change adopted must greatly increase the inconvenience and other evils now alleged to exist. The appearanee often presented by cattle in the streets, and which had been made the subject of comment, was to be ascribed to long-existing disease, and not to cruelty of treatment, which had of late years greatly diminished, and which he himself would be the last to justify. Much of the inconvenience at present existing might be rectified by a more rigid observance of the police regulations and those of the Court of Aldermen affecting animals passing to or from the market. These regulations he detailed and commented on at some length. The hon. gentleman proceeded to examine the evidence given before the committee of the House of Commons whieh, in 1847, inquired into the state of the market. That evidence, he considered, did not justify its removal. If the removal was effected his interests would be benefited thereby, but he was bound to say that he considered Smithfield Market as a great safety-valve for the trade of the City—(Laughter). There were abattoirs in the exterior of Paris, but London had no exterior. As to the subject of health, Mr. Lawrence and Dr. Burroughes had given most unequivocal testimony in favour of the salubrity of Smithfield, wherein were St. Bartholomew's Hospital, the Charter-house, and Christ's Hospital. Sir Charles Knightley, the first grazier in England, had given his unqualified opposition to any proposition for abolishing the market, and so had many others of the highest respectability. Smithfield was a chartered market, and, as the present attempt was to deprive the corporation of the rights which they possessed under that charter, he hoped they would reject the motion.

Mr. Godson followed on the same side, addressing his observations principally to prove the absence of cruelty towards the cattle, and to the total failure of evidence that the market had an injurious effect upon the health of the neighbourhood.

Mr. Anderton advocated the positive convenience arising from the central position of Smithfield. He had that morning paid a visit to the new market at Islington, understanding it to be the market-day, and expecting to find it crowded with cattle; but, when he arrived there, at a quarter-past eight o'clock, the gates were locked, and there was not an animal in the market but himself—(Laughter). Had there been, though the morning was frosty, they would have been up to their knees in slush and dirt, as there was but one road for them to pass along in entering or leaving. They were told that property was depreciated by the vicinity of the market, and straightway it was recommended to move the market to the suburbs, that it might produce the same effect there. Was this a question between the corporation and the philanthropists? No, but with a gentleman who had laid out a large sum of money on the Islington experiment, and would be very glad to get it back again. Philanthropy, indeed! He held in his hand the prospectus of a new Smithfield Market, the issue of shares in which was to be to the value of £400,000. An income of £47,000 was calculated on, and profit on the capital invested at the rate of 18 per cent. Mr. Anderton concluded by declaring that they were bound, in duty to themselves and their fellow-citizens, to maintain the market as long as the Legislature allowed them to do so.

Mr. Bennoch and Mr. Blake spoke in support of the original motion.

Alderman Lawrence ridiculed the idea of removing ten or twelve miles from London a market intended to supply meat to two millions of people. There was a total want of facts to justify the elamour whieh had been got up against Smithfield, and it was now shown that the experiment at Islington had entirely failed. He supposed that Billingsgate would be the next point of attack, and, when this had been successfully attempted, perhaps it would last of all be considered desirable to remove the Royal Exchange to Finchley-common—(Laughter). An attempt had been made to garble the evidence which had been produced before the committee of the House of Commons in 1847. That evidence told so strongly against those who came prepared to object to the market that the House threw out the bill. Lord R. Grosvenor broke down eompletely in giving his evidence before the committee. Then as to the question of health, they had on that point the testimony of the first medical men of the day,—men whose names stood above eavil, and, therefore, he took it for granted that the court would trust that evidence. The removal of Smithfield Market was a very favourite theme, but how many one-horse carts would the butchers require if that was effected?

Mr. Bennoch: Have a railway.

Alderman Lawrence: Then there must be a railway from the market ending at every butcher's door. The same arguments would apply to Leadenhall Market and to Newgate Market. The subject had already undergone a thorough investigation, and, if they were told that public opinion was against them, he asked what was public opinion? The press found it convenient to pen an article that would sell, and they knew that slander against any man would sell better than any other article they could manufacture. He had heard that the part of the press which was called respectable did not disdain to put words into the mouths of individuals that had never been spoken by them, in order to carry out

their own dirty practices—(Uproar). He knew very well that this would be reported, and the only way would be to laugh down what he had said. But no one doubted the venality of the press—(Uproar). Few would speak out because they would be shown up in consequence ; but he gave his opinion fearlessly. They would perhaps report him very shortly for what he said, but was the press the public? No. The slander of the press was most profitable—(Cries of "Question!"). The hon. gentleman who cries "Question" is perfectly safe. The press will give him a full share in its space to-morrow, but he was not to be deterred by it from speaking his mind. He asked the court to stand by its own convictions, and not to be afraid of any set of men. As far as profit was concerned he wished the corporation was well rid of Smithfield, but he believed that the market never could be half so well situated in any other place as there.

The debate was then adjourned till Thursday.

New Coal-pit Ventilator.—The frightful loss of life occasioned by the recent coal-pit explosion at Darley Main has doubtless instigated many humane and scientific minds to investigate the causes of these awful calamities, with a view to lessen their recurrence, or, at least, to diminish the fearful loss of life which too frequently results from them. Actuated by such praiseworthy and philanthropic motives, Dr. Dunn has, we are glad to announce, succeeded in completing a very simple and apparently efficacious invention for the ventilation of coal-pits. We have been favoured with a view of Dr. Dunn's model, which we could describe in a few words if necessary, but which, for certain reasons, is to be kept secret for the present; not, indeed, that Dr. Dunn contemplates any pecuniary advantage from his invention, but he is desirous that other persons shall not be enabled to make profit of that which is intended solely to benefit mankind at large. It is well known that in coal-pit explosions the great majority of the sufferers lose their lives by suffocation, only a few comparatively being killed by the mechanical force of the explosion. It is known, moreover, that one of the main causes of these explosions is the imperfect ventilation of the pits; and it is to remedy this defect that Dr. Dunn's contrivance has been invented. By this machine, it is calculated, a constant and abundant stream of pure air, sufficient for any area, can be admitted into the pits. At present when a gale of wind occurs it sweeps over the mouths of the pits and forms an eddy therein ; this eddy does not extend more than six or seven feet below the surface of the earth, and it has not a sufficiently spiratory motion either to allow of the mephitic air of the pits ascending or the purer air to descend,—a circumstance which obviously hastens the danger and increases the force of the explosions when they do occur. Dr. Dunn proposes by his simple contrivance to convey the atmospheric air directly to the bottom of the pits, and, if necessary, thence by an horizontal extension of the machine to other parts of the pit where it may be required. The advantages of such an invention are obvious; and, when we add that it may be erected at an expense of £5, we have no doubt the cheapness as well as the simplicity and efficiency of the invention will cause it to be universally adopted. The machine will shortly be tested at one of the neighbouring pits, and in the meantime, for the reasons above mentioned, Dr. Dunn will secure his invention by registering it. We ought to state that Mr. Jarratt, one of the proprietors of Darley Main Colliery, has inspected the machine, and is very sanguine as to its success.

Extraordinary Vocal Phenomenon.—At a lecture delivered in the ordinary course of physiology at the School of Medicine, adjoining St. George's Hospital, on Thursday afternoon (Feb. 22), by Dr. W. Vesalius Pettigrew, the subject of which was "The Voice," the lecturer took the opportunity of introducing Mr. Richmond, who possesses the wonderful power of producing two vocal sounds at a time, and these in harmony. Mr. Richmond commenced by producing a modulated bass tone, according to Dr. Pettigrew's opinion, in the upper part of the pharyngeal and nasal cavities, and almost instantly a treble accompaniment, which the lecturer had no doubt was produced by the vibration of air over the thin and expanded edges of the tongue, the vibrations being manipulated by the most adroit management of the muscles of that organ. The treble tones cannot be produced unless the tongue be fixed at its base to the hyoid bone, and by its apex to the roof of the palate. The treble tones produced were of the sweetest and most melodious character, far surpassing in softness any known musical instrument, or even vocal organ of the bird, and elicited the most enthusiastic applause from a most crowded theatre, consisting of students, many of the most eminent physicians and surgeons, and numerous scientific gentlemen, who had assembled to witness the performance.

Discoveries of Gold in Africa.—A letter from St. Petersburg says:—"Scarcely are the gold bearings of California discovered when others are found in the interior of Africa. Colonel Kavelowski, of St. Petersburg, who for a long time has directed the vast mines in Siberia, and who is at present exploring, in a mineralogical point of view, the interior of Africa, has met with, on the right bank of the Somat, at one day's journey from Casson, several large hills of auriferous sand. He tried to wash these sands, and that operation proved to him that they contain much more gold than those of Siberia. M. Kavelowski carried his researches further. He examined the banks of the Ramia, of the Dys, the Goucka, the Benisch-Angol, and of the Kamanil, and he has found there portions, more or less in extent, of gold sands. He proposes that miners and gold-washers should be sent from Russia to sound the grounds, and to make some trials on a large scale of the washing of the sands."

Colliery Explosions. — On Wednesday, February 28, by appointment, made by several members of the late and present Governments, a series of experiments was exhibited illustrative of the application of Mr. Gurney's system of high-pressure steam to the ventilation of coal mines, as given in his evidence before the committee of the House of Commons on "Accidents in Mines" in 1835. The theatre of the Royal Polytechnic Institution was selected, as having at command the hydro-electric machine steam apparatus, made use of in the recent lectures on the steam-jet at the institution, which led to the adoption of the method of ventilation lately introduced by Dr. Foster at Newcastle. Dr. Bachhoffner demonstrated the principle by a series of conclusive experiments, which were afterwards followed by a discussion, in which Mr. Gurney, who was present, practically explained its application to coal mines as a positive means of preventing the many distressing accidents which so frequently occur. Amongst the company present were—Earl of St. Germans, Marquis of Lansdowne, Sir Robert Peel, Sir James Graham, Sir J. Walmesly, Right Hon. Sydney Herbert, Mr. Joseph Hume, M.P., Lord Ashley, Sir Charles Lemon, Mr. Edward Cayley, M.P., Mr. J. Pendarves, M.P., Admiral Bowles, Admiral Hope, Mr. E. Brotherton, M.P., Mr. Charles Forster, M P., and a number of other gentlemen connected with the Government, and the directors of the institution.

Red Lake.—A very fine red lake may be prepared as follows :—Take 1 oz. of coarsely powdered cochineal, 2 oz. of rectified spirits of wine, and the same quantity of water; digest for a week, filter, and precipitate with a few drops of solution of tin, added every two hours, till the whole of the colour is thrown down; wash in distilled water, and dry.

Solubility of Zinc in Fatty Oils.—The metal zinc, now so generally used for vessels of capacity, forms, it cannot be too generally known, with fatty bodies a class of remarkably poisonous salts. With olive oil these salts are the oleate and margarate of oxide of zinc.

TO CORRESPONDENTS.

"Mr. Charles Cotton, Plymouth."—Sulphate of soda has the unusual property of being less soluble in boiling water than in water at 100° F. It is not at all astonishing, therefore, that you should find it difficult to dissolve a large quantity of it in a small quantity of boiling water. The proportions which water will respectively dissolve at different temperatures are as follows:—100 parts of water at 32° F. dissolve 12 parts of the salt, at 64.5 F. 48 parts, at 77° F. 100 parts, at 89.5 F. 270 parts, at 91.5 F. 322 parts. But if the heat be now increased beyond this point a portion of the salt will be deposited again. One ton of sulphate of soda will accordingly require a little more than one third of a ton of water at 91.5 F. for its solution.

"A Constant Reader."—We do not think there is any error in the specification alluded to.

"Chemicus, Liverpool."—You had better apply to Dr. Sheridan Muspratt, who, we doubt not, will give you the desired information.

"Inquirer."—The name mercaptan was given by Professor Zeise, of Copenhagen, to one of the constituents of the ethereal liquid which passes over along with water, upon the distillation of sulphovinate of baryta, with a strong solution of protosulphuret of barium; the other constituent of this liquid is called thialic ether. Mercaptan exercises a very energetic action on peroxide of mercury,—hence its name (Mercurium captans).

"Mr. Millar, Birmingham."—Both works are equally good.

"Mr. Reginald Lowry, Truro."—The subject is under consideration. We will communicate the result to you as soon as possible.

"J. P."—We must decline for the present.

"Mr. Richard Worsted, Whitechapel."—No stamp is required.

"Inquirer, Manchester."—Bunsen's charcoal battery is the most powerful.

"Mr. Lloyd, Chelsea," is referred to Professor Grove's lecture on voltaic ignition (vide *Chemical Times* of last week).

"Chemicus."—We will endeavour to ascertain the details.

"Mr. J. Walden."—Apply to Professor Hofmann, or to the secretary of the Royal College of Chemistry, Hanover-square.

"Mr. Richard Snell."—We cannot undertake to analyze the article.

"T. R. M."—There are two sorts of rouge dishes. One is made in Portugal, and is rather scarce ; the paint contained in the Portuguese dishes is of a fine pale pink hue, and very beautiful in its application to the face. The other sort is made in London, and is of a dirty red muddy colour ; it passes very well, however, with those who never saw the genuine Portuguese dishes, or who wish to be cheaply beautified. The most marked difference between these two sorts is, that the true one from Portugal is contained in dishes which are rough on the outside ; whereas the dishes made here are glazed quite smooth. To make mild rouge, take Briançon chalk, reduce it to a very fine powder, add to it carmine in proportion to the vividness of the red which you intend to produce, and carefully triturate this mixture, which may be applied to the skin without danger. The makers of rouge, out of economy, sometimes substitute cinnabar for carmine. You may ascertain if carmine be genuine by its not being altered either by oxalate of ammonia or by potass.

"A Confectioner."—All the salts of lead are poisonous. Chrome yellow should never be used to colour sugar.

"E. M., Glasgow."—Your article shall appear next week.

"G. D. L." will find that we have complied with his request.

"X. Y. Z."—We will endeavour to ascertain.

"Mr. Smily, Brompton."—We cannot say. You had better apply at the Apothecaries'-hall.

"W. R. T."—The paper is not adapted for our pages. The MS. is left at the office.

"Mr. Jones, Chelsea."—A beautiful lemon colour may be formed by mixing together the sulphuret and sesqui-sulphuret of arsenic (realgar and orpiment); but these colours, which may be imitated in another manner, have the disadvantage of being of a poisonous quality. It will therefore be better to substitute in their room Dutch pink of Troyes and Naples yellow. This composition is proper for distemper, and for varnish ; when ground and mixed the result will be a bright solid colour, without smell, if an alcoholic varnish be applied for the last coating.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London : Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London ; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster,—March 3, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLVIII.

(LECTURE LXXVI.)

EXTRACTIVE.

SECTION V.—BITTER EXTRACTIVE ASSOCIATED WITH ESSENTIAL OIL.—(*Continued.*)

CRUCIFERÆ.

The family of the Cruciferæ, so remarkable for the analogy of the botanical characters of the plants composing it, is equally remarkable for the similarity of properties presented by these plants, and their several respective parts. This similarity of properties is such that, with due regard to, and allowance for, the respective greater or less activity of the several plants, they may be almost indiscriminately substituted for one another.

The cruciferæ are rich in nitrogen, and it is probably for this reason that they grow with particular vigour in the vicinity of our habitations, and that cultivation rather tends to increase their medicinal properties than otherwise. All the cruciferæ contain sulphur; this element forms one of the constituent principles of the acrid volatile oil to which the cruciferæ owe their chief property, and which is almost identically the same in every one of the several species belonging to that family. In the mustard plant sulphur has been found also in a fixed crystallizable principle, to which the name sinapisin has been given.

It is to the volatile oil that the cruciferæ owe their chief property. The several plants of this family and their divers parts yield the volatile oil respectively in different proportions; the seeds yield a large amount of it. The several species of sinapis are particularly remarkable in this respect. Under the name of mustard we use in Europe the Sinapis nigra, arvensis, and alba. The Sinapis sinensis is used in China, the Sinapis dichotoma and racemosa are used in East India. The seeds of Sysimbrium and of Brassica eruca, and rapeseed also, though the latter in a more feeble degree, have analogous properties to those of the seeds of the various species of sinapis.

All the seeds of the cruciferæ contain, besides the volatile, also a fixed oil, of mild taste, but which acquires usually a disagreeable flavour in the process of extraction, owing to intermixture with the other principles present in the seeds.

The formula of the volatile oil of the cruciferæ is:—

$$C_8 H_5 N_1 S_2.$$

The volatile oil which the mustard yields may be considered as the type. This oil is found in:—

Cochlearia officinalis,
Cochlearia armoracia (root),
Cochlearia draba,
Iberis amara,
Capsella bursa pastoris,
Raphanus raphanistrum,
Sysimbrium officinale,
Brassica napus,
Cheirantus annuus.

The root of Erysimum alliaria contains the same essence; its leaves yield an essential oil analogous to that of garlic—

$$(C_8 H_5 S)$$

These two essences, though distinct and differing in some respects, have certain strong affinities, and are susceptible of mutual transformation into one another. The seeds of Thlaspi contain a mixture of these two essences.

The seeds of Lepidium ruderale, L. sativum, and L. campestre, yield an intermediate essence which smells like garlic and tastes like cresses.

Pleiss, to whom we are indebted for the greater part of these observations, has observed also that, when erysimum alliaria is exposed to the sun, the garlic essence is frequently replaced by the common volatile oil of the cruciferæ.

The cruciferæ act upon the organism as strong stimulants. When the active principle in them is highly concentrated, as in the root of horseradish and in that of Iberis latifolia, it may act as a rubefacient; in a more dilute state it is a useful internal remedy.

The cruciferæ produce in the stomach a transitory sensation of heat. A general activity results, of which the effect is only momentary, however. The active principle is speedily eliminated, and betrays by its smell its presence in the perspiration, milk, and urine.

It is this remarkable action of the cruciferæ which has gained them a well-deserved reputation in all diseases attended with debility. They are used more particularly in scrofulous or scorbutic affections We associate with them frequently tonic substances of which the more durable action maintains the too transitory effects of the cruciferæ. Some of the latter, as cresses and cochlearia for instance, contain naturally this association of acrid and bitter principles.

The cruciferæ are given with success in chronic catarrhs; they facilitate the secretion of the mucus and speedily reduce its quantity. We use for this purpose the syrups of erysimum, of cresses, and of red cabbage; for these may be substituted more energetic antiscorbutics, the dose being regulated, of course, according to their respective vigour of action.

The active principle of the cruciferæ abounds in the roots of Cochlearia armoracia and Iberis latifolia, which latter is substituted for the former in some parts in the south of France.

The active principle abounds equally in the black radish (raphanus niger), which is used rather as an article of food than as a remedial agent. Turnips, cresses, and cabbage, are also used principally as articles of food: the volatile matter, enveloped, as it is in these plants, by, and distributed through, a soft and fleshy tissue, serves here as a condiment.

As the properties of the cruciferæ reside chiefly in a volatile principle, the application of heat must be avoided in their pharmaceutical treatment. The mere process of drying suffices to weaken their properties considerably. Accordingly, these plants are almost invariably used fresh, and frequently in the state of juice. Where it is necessary to have recourse to the action of fire, the operation must be conducted in a close vessel, or distillation must be resorted to.

The following are the most frequently employed of the cruciferæ:—

Brassica oleracea,
Cochlearia officinalis,
Nasturtium officinale,
Sysimbrium officinale,
Sinapis nigra,
Sinapis alba,
Brassica napus,
Cochlearia armoracia.

§ I. PREPARATIONS WHICH CONTAIN THE WHOLE SUBSTANCE OF THE CRUCIFERÆ.

PRESERVE OF COCHLEARIA.

Take of Picked leaves of cochlearia, 1 part.
White sugar, 5 parts.

Pound the leaves in a marble mortar with the sugar until the whole mass is reduced to a pulp. Strain through a hair sieve.

The preserve of cresses is prepared in the same way.

§ II. JUICE OF THE PLANTS.

The juice of the cruciferæ contains both the bitter and the acrid and volatile principles of these plants. Upon evaporation the juice leaves an extract, which is, however, hardly ever employed in medicine, since the volatile principle is completely dissipated during the process of evaporation. Some of the extracts of the cruciferæ contain, however, extractive and saline matters which are not without efficacy; but these may be readily replaced by other and more active preparations possessed of the same properties.

JUICE OF CRESSES.

Pound the cresses, subject the pulp to the action of the press, and filter the juice without the aid of heat.

The juice of cresses prepared without the aid of heat possesses all the properties of the plant. In some cases, however, we are obliged to heat it; this ought to be done in a close vessel. The juice loses by this proceeding some of its pungency, but it preserves the whole of its bitterness.

The juice of cochlearia is prepared in the same manner.

ANTISCORBUTIC JUICES.

Take of Leaves of Cresses,
" Cochlearia,
" Menyanthes trifoliatia, of each equal parts.

Mix and pound the leaves, subject the pulp to the action of the press, and filter through paper, without having recourse to the aid of heat.

SYRUP OF CRESSES.

Take of The non-depurated juice of cresses, 16 parts.
Sugar, 30 parts.

Heat in the water-bath to dissolve the sugar, and strain the solution when cold.

Syrup of cochlearia is prepared in the same way.

SYRUP OF RED CABBAGE.

Take of Red cabbage leaves, 5 parts.
Water, 1 part.

Pound the red cabbage leaves in a marble mortar, add the water to the pulp, and strain with strong expression. Clarify the juice by heat in a glass matras, strain, and add to the liquid double its own weight of sugar. Form a syrup by simple solution in a glass vessel, at the heat of the water-bath.

This formula, which was originally proposed by MM. Henry and Guibourt, has been adopted since by the Codex. It yields a very good product; the syrup is a purer and more lively colour than that prepared by coction, according to the ancient formula. It is, indeed, a little less mucilaginous than the latter, but the difference in this respect is too trifling to deserve attention.

The syrup of red cabbage contains a certain amount of the active principle of the cruciferæ, which imparts to it a peculiar stimulating property; it is for this reason that it is given sometimes in chronic catarrhs.

The colour of the red cabbage is exceedingly sensible to the action of reagents; alkalis turn it green, acids red, mere contact with tin suffices to turn it violet. The greatest care should accordingly be taken to use for straining, &c., linen only that has been thoroughly freed by washing from every particle of alkaline matter.

§ III.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON THE CRUCIFERÆ.

The cruciferæ should be treated by infusion in a close vessel; the liquor is to be strained when cold. The plants being used fresh, boiling water is indispensable to extract the soluble parts.

Infusion of horseradish intended for a ptisan is usually prepared with 30 grammes of the root, per quart of water. Infusion of cresses or cochlearia is prepared with 30 grammes of the plants, per quart of water.

ANTISCORBUTIC POTION.

Take of Dry roots of bardana (burdock),
" rumex patientia,
Fresh horseradish root,
Fresh leaves of cochlearia,
" cresses,
Leaves of menyanthes trifoliata, of each 16 grammes.
Boiling water, 2,000 grammes.

Pound the dry roots, incise the horseradish

and the leaves, and let the whole mass infuse in the water for two hours in a close vessel.

The antiscorbutic potion of the Paris hospitals is prepared as follows:—

Take of Bitter species, 8 grammes.
Spirit of cochlearia, 16 grammes.
Boiling water, 1,000 grammes.

Let the bitter species infuse in the water for one hour; strain; allow the liquid to cool, and add, subsequently, the spirit of cochlearia.

DISTILLED WATER OF COCHLEARIA.

Take of Incised leaves of cochlearia, 1 part.
Water, a sufficiency.

Distil over the naked fire, and draw off one part of product.

The distilled water of cresses is prepared in the same way.

I have remarked that the distillation according to the ancient method (viz., keeping the plants immersed in the water from the beginning of the process) yields a superior product as regards smell and flavour. This is more particularly the case with cochlearia; the distilled water of the latter is unquestionably more richly charged with essential oil than the water of cresses. The cause of this is that, besides the acrid oil which pre-exists in the fresh plant, the latter contains also the elements necessary for the production of a fresh quantity of volatile oil, which production is determined by the contact of the torn and incised tissues with water. The formation of this oil, like that of the bitter almond oil under similar circumstances, requires a certain time; and it is most probably for this reason that the proportion of essence formed is smaller if the plant has been steeped at once into the aqueous vapour of 212° Fahrenheit, instead of being kept immersed in the water in the still from the commencement of the process. The circumstance that the dried cruciferæ are susceptible of reproducing volatile oil on being treated with water may be explained on the same principle.

DISTILLED WATER OF HORSERADISH.

Take of Incised horseradish roots, 1 part.
Water, 5 parts.

Let the roots macerate in the water for one day, and distil subsequently over the naked fire; draw off two parts of product.

The first half of the liquid which passes over is turbid, and has a very strong flavour; the second half is very feeble. The mixture of the two constitutes a very energetic preparation.

The distillation over the naked fire is preferable to the distillation in the steam apparatus. I have tried the latter process, and found that the first half of the product was transparent and weaker than that obtained by the former process. The second half of the product was weaker than the first, though, on the other hand, stronger than the second half of the product obtained by distillation over the naked fire. The mixture of the two liquids which I obtained by the distillation in the steam apparatus was weaker than the product obtained by the distillation over the naked fire. This difference appears to be owing to the circumstance that horseradish does not contain the whole of the volatile oil ready formed. Indeed, if you tear the root in a longitudinal direction, you will perceive a comparatively feeble odour only, whereas upon bruising the root, and thus intermingling its different parts, the smell becomes at once most powerfully pungent.

The essence of horseradish is perfectly identical with that of mustard-seeds.

ANTISCORBUTIC SYRUP.

(Compound Syrup of Horseradish.)

Take of Leaves of Cochlearia,
" Cresses,
" Menyanthes trifoliata,
Horseradish-root,
Bitter oranges, of each 100 parts.
Cinnamon, 3 parts.
White wine,
Sugar, of each 400 parts.

Bruise the leaves, incise the horseradish, slice the bitter oranges, pound the cinnamon, and place the whole mass, together with the wine, in a tin water-bath. After the lapse of twenty-four hours distil in the water-bath, and draw off 100 parts of product. Dissolve in the liquid 190 parts of sugar in a close vessel.

Strain the residuary matter which remains in the alembic, with slight squeezing, and convert the fluid, with the remainder of the sugar, by coction and clarification, into a somewhat concentrated syrup. When this is cold add to it the first syrup.

In the distillation which precedes the preparation of the syrup the volatile oil of the cruciferæ passes over into the receiver. It is, to a great extent, dissolved by the alcohol of the white wine, and that portion of it which is simply suspended in the distillate dissolves, likewise, upon the addition of the sugar.

The helms of the alembics used for the preparation of the distillate are found to blacken. This is owing to the formation of sulphuret of lead resulting from the decomposition of part of the volatile oil, and the combination of the sulphur (which forms one of the constituent elements of the latter) with the lead with which the tin of commerce is mostly contaminated.

COMPOUND SYRUP OF SYSIMBRIUM.

Take of Winnowed and cleansed barley,
Dry raisins,
Liquorice, of each 4 parts.
Borage,
Chicory, of each 6 parts.
Boil in
Water, 400 parts,
until reduced by one fourth.
Strain, and pour boiling water over—
Fresh sysimbrium, 100 parts.
Elicampane-root, 8 parts.
Canadia maidenhair, 2 parts.
Rosemary,
Lavandula stœchas, of each 1 part.
Anise, 1½ part.

Let the whole mixture macerate for twenty-four hours; distil subsequently, and draw off sixteen parts of product.

Add to these sixteen parts—
Sugar, 29 parts.

Prepare a syrup by simple solution.

Strain the residuary mass which remains in the cucurbite, and add to the fluid—
Sugar, 100 parts.
Honey, 33 parts.

Prepare a syrup secundum artem, and add to this the first syrup.

The compound syrup of sysimbrium facilitates the expectoration in chronic catarrhs.

It enjoys great reputation against hoarseness

TURNIP SYRUP.

Take of Fresh turnips, 1 part.
Water, 4 parts.
Sugar, 2 parts.

Peel the turnips, slice them, and boil the slices in the water at a gentle heat. Strain without squeezing, add the sugar to the liquid, and prepare a syrup by coction and clarification.

Ebullition is resorted to in the preparation of this syrup, because the intention here is to preserve the saccharine and mucilaginous principles of the turnip, and not the volatile principle.

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§ IV.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON THE CRUCIFERÆ.

These are divided into two classes, viz.:—

1. Products obtained by distillation, and which contain simply the acrid volatile principle.

2. Products obtained by maceration, and which contain both the volatile and fixed principles.

ALCOHOLATE OF COCHLEARIA.

Take of Bruised leaves of cochlearia, 9 parts.
Alcohol of 80 C. (31° Cartier), 6 parts.

Distil to draw of 5 parts of product.

The alcoholate of cresses is prepared in the same way. Both these alcoholates are excellent preparations, which place, for the whole year round, at the disposition of the practitioner the acrid and volatile principle of the cruciferæ.

COMPOUND ALCOHOLATE OF COCHLEARIA.

Take of Bruised cochlearia leaves, 8 parts.
Horseradish-root, cut in thin slices, 1 part.
Alcohol of 80 C. (31° Cartier), 10 parts.

Distil in the water-bath, and draw off 8 parts of product.

Herberger has examined a stearoptenic deposit which he found in the compound spirit of cochlearia. It presented the aspect of crystalline needles; it was inodorous, but had a burning and pungent taste. Placed on the fire, it emitted a strong horseradish odour. M. Baumé has observed a crystalline deposit of sulphur in the compound spirit of cochlearia. M. Lepage has made the same observation.

ANTISCORBUTIC GARGLE.

Take of Bitter species, 2 grammes.
Boiling water, 250 grammes.
Honey syrup, 32 grammes.
Compound spirit of cochlearia, 16 grammes.

Let the bitter species infuse in the water for one hour; strain, and add to the liquid the syrup and spirit.—(Hospitals of Paris.)

COMPOUND ALCOHOLATE OF COCHLEARIA AND CRESSES.

Take of Leaves of cochlearia,
" cresses, of each 16 parts.
Cinnamon, 4 parts.
Fresh lemon-peel,
Red roses,
Cloves, of each 2 parts.
Alcohol of 80 C. (31° Cartier), 100 parts.

Let the solid ingredients macerate in the alcohol for four days. Distil off the whole of the alcohol used.

The distillate is used as a dentifrice. Diluted with water, it forms an excellent wash for the mouth, and strengthens the gums.

ALCOHOLIC TINCTURE OF THE CRUCIFERÆ.

The simple alcoholic tinctures of the cruciferæ are hardly ever used, although they constitute most excellent preparations; they contain, like the alcoholates, the volatile principle of the plants, and, besides, the fixed bitter principle which is present in several of the cruciferæ.

ANTISCORBUTIC TINCTURE.

(Compound Tincture of Horseradish.)

Take of Horseradish-root, 4 parts.
Bruised mustard seeds (Sinapis nigra), 2 parts.
Hydrochlorate of ammonia, 1 part.
Alcohol of 56 C. (21° Cartier),
Compound spirit of cochlearia, of each 8 parts.

Let the solid ingredients macerate for eight days in the alcohol and spirit of cochlearia; strain with expression, and filter.

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§ V. PRODUCTS OBTAINED BY THE ACTION OF WINE UPON THE CRUCIFERÆ.

ANTISCORBUTIC WINE.

Take of Horseradish-root, 6 parts.
Fresh leaves of cochlearia,
" cresses,
" menyanthes trifoliata,
Bruised mustard seeds, of each 3 parts.
Hydrochlorate of ammonia, 1½ part.
Generous white wine, 200 parts.
Compound spirit of cochlearia, 3 parts.

Let the solid ingredients macerate for eight days in the wine and spirit; strain and filter.

In the preparation of the antiscorbutic wine the general rule is set aside which prescribes to place only dry plants in contact with wine; in this case there is an absolute necessity to use the fresh plants; the acrid volatile principle of the cruciferæ serves, moreover, here as a condiment, and opposes the fermentation of the wine.

The antiscorbutic wine is used at the dose of

30 to 120 grammes in scorbutic affections, and in affections resulting from general debility.

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§ VI. PRODUCTS OBTAINED BY THE ACTION OF BEER UPON THE CRUCIFERÆ.

ANTISCORBUTIC BEER.

Take of Fresh cochlearia-leaves, 1 part.
Fresh horseradish-roots, 2 parts.
Dry buds of the fir-tree, 1 part.
Beer, 64 parts.

Macerate the solid ingredients in the beer for two days; strain.

BLACK MUSTARD SEED.

(Sinapis Nigra).

The seeds of the cruciferæ do not contain volatile oil, but they contain the elements required to form it. These elements (or, more correctly speaking, the volatile oil which they form under certain conditions) impart to these seeds properties identical with those of the fresh plants.

The seeds of black mustard (Sinapis nigra) possess to a high degree the property of forming an essential oil.

These seeds are composed of:—

A sweet fixed oil,
Vegetable albumen,
Myrosin,
Myronate of potass,
Sugar,
Gummous matter,
Colouring matter,
Nacreous matter,
Free acid,
Sinapisin,
A peculiar green principle,
Some salts,

a composition which, it will be seen, is, upon the whole, analogous to that of the emulsive seeds. The fixed oil forms about 28 per cent. of the whole.

The nacreous matter is of fatty nature, and presents but little interest.

The green matter has hardly been examined yet.

It should be observed that none of the elements contained in the seeds of mustard possess the acridity which is regarded as the principal property of mustard in a medicinal point of view. This acridity does not pre-exist in fact in the seeds, but is the result or product of the mutual action which the several elements contained in the seeds exercise upon one another under certain conditions.

MM. Robiquet and Boutron treated mustard-seeds with alcohol; they found that neither the liquor nor the residue possessed the slightest acridity. And again, no odour whatever is perceived when mustard-powder is exposed to the heat of the water-bath. It is the presence of water that constitutes the indispensable condition for the formation of the acrid volatile oil. When the bruised mustard-seeds are placed in contact with water, a reaction ensues between the elements of the water and some of the principles of the seeds; the principal result of this reaction is the formation of the volatile oil of mustard. The temperature of the water has a marked influence on the formation of this oil. M. Hesse and M. Fauré have observed that the formation of the oil does not take place in boiling water. According to M. Fauré, the quantity of oil formed diminishes in proportion as the temperature of the water exceeds 140° Fahr., and the formation of the oil ceases to take place in water heated to 167° Fahr.

Weak sulphuric acid, and, in general, the mineral acids, oppose the formation of the volatile oil. Carbonate of potass exercises the same influence. The vegetable acids produce this effect only when of a certain degree of concentration (3 degrees of the areometer). The oil once formed, the acids have no longer any influence to oppose or prevent the manifestation of its effects. The neutral salts of the alkalis and of the alkaline earths are in general without influence upon the formation of the volatile oil of mustard. Some of the metallic salts, those of mercury and copper for instance, oppose its formation.

MM. Boutron, Fremy, and Bussy have studied the reaction which ensues between the elements of the water and the constituents of the mustard seeds, and ascertained to which of these constituents the formation of the volatile oil is more immediately attributable. The black mustard seeds contain a species of ferment, called myrosin, and which presents the greatest analogy of properties with albumen. Myrosin is obtained by treating the mustard cake with water, evaporating at a low temperature, and precipitating with alcohol. It is coagulable by heat and by the acids. By coagulation it loses the property to ferment, which it recovers only after the lapse of some time, and gradually.

The myronate of potass is the body which furnishes the volatile oil, and the formation of the latter is determined by the decomposition of this salt under the influence of the myrosin; besides the volatile oil, a matter is produced which renders the liquor turbid, and in which are found globules analogous to those of beer yeast.

Myronate of potass forms fine, colourless, transparent crystals, which are very soluble in water, and tolerably so in dilute, but insoluble in absolute, alcohol. The myronic acid which enters into the composition of these crystals contains carbon, sulphur, nitrogen, oxygen, and hydrogen.

Myronate of potass may be obtained by the following process:—Act upon the mustard cake with alcohol of 85C, until the principles soluble in that menstruum are dissolved out; squeeze the cake, and treat it with water. Evaporate the aqueous solution to the consistence of a very thin extract, and precipitate this with weak alcohol. The myronate of potass will now crystallize upon evaporation of the liquid; the crystals are purified by washing with weak alcohol.

The volatile oil of mustard is white or citron-coloured. It is excessively acrid, and induces a copious secretion of tears. It boils at 298.4 Fahr. It is slightly soluble in water. It separates from the latter fluid with some difficulty, the specific gravity of the two differing but slightly. It dissolves readily in alcohol and in ether.

The essence of mustard has a remarkable composition. It contains carbon, hydrogen, nitrogen, and sulphur, but no oxygen. Its formula may be written thus:—

$$C_8 H_5 N S_2.$$

This is equally the composition of the essence of cochlearia according to Simon, of that of horseradish according to Tubatka, and of that of the root of Erysimum alliaria according to Wertheim. The essence of mustard combines with ammonia, giving thus birth to the formation of a new alkali (Thiosinamine), of which the composition may be represented by one equivalent of essence and one of ammonia.

The alkalis decompose the oil of mustard, and convert it into oil of garlic.

POWDER OF MUSTARD-SEEDS.

(*Mustard-seed Meal.*)

Reduce the seeds to powder in a mortar, or grind them in the mill. When operating in a mortar a somewhat large-headed pestle should be used.

Fresh mustard-seeds yield a much less active powder than seeds that have been previously dried in the stove.

Apothecaries should always prepare their own mustard meal. This is one of the most energetic remedies, and one upon the genuineness of which the physician should be able to rely fully. The life of the patient often depends upon the rapidity of its action. Now, the mustard meal of commerce is hardly ever pure, and in some instances it is adulterated to a frightful extent.

M. Robinet recommends to remove from the mustard meal intended for poultices the fixed oil (by expression). The meal freed from the oil is less liable to turn rancid, and acts, moreover, much more energetically. For this latter reason it should never be given in this state, except upon the express prescription of the physician.

MUSTARD FOMENTATION.

Take of Mustard meal, 1 part.
Lukewarm water, 4 parts.

Apply this mixture spread upon compresses.—(Fouquier.)

FOOT-BATH WITH MUSTARD.

Take of Mustard meal, 60 to 200 grammes.
Lukewarm water, a sufficiency.

Make the mustard into a very thin paste with the water, cover the vessel, and let it stand at rest for some time (the longer the better). Add the requisite amount of water (and of the requisite temperature) to make up the bath.

The observations of MM. Robiquet and Boutron regarding the obstacle which the presence of acids and alkalis opposes to the formation of the volatile oil of mustard teach us, of course, to avoid the use of any such ingredients in foot-baths with mustard, or, at all events, to add them only after the oil has had sufficient time for its development. It is for the same reason that the mustard meal is mixed, in the first instance, with lukewarm water.

SINAPISMS, OR MUSTARD POULTICES.

Sinapisms are poultices made with mustard meal. They are commonly prepared with vinegar; but, as acids exercise an unfavourable influence on the development of the active principle of the mustard, it is greatly preferable to use cold water instead of vinegar. Boiling water would, as I have already observed, altogether fail to answer the purpose; but water of 86° to 104° F. may be used without danger of interfering with the development of the active principle of the seeds.

Sometimes we add to sinapisms certain substances which, from their acridity, are thought likely to increase the energy of the action. The principal of these are pepper, garlic, and cantharides. The pepper is reduced to powder, and the latter sprinkled over the surface of the poultice. The garlic is reduced to pulp without the aid of heat, and the pulp mixed up with the mustard meal, &c. Cantharides are reduced to powder, and the latter is mixed with the poultice mass; or the tincture of cantharides is used, either mixed up with the whole mass of the poultice or simply with the upper layer.

The fixed oil of mustard seeds is naturally mild and sweet, and contributes nothing to the rubefacient properties of sinapisms; on the contrary, its presence serves to dilute the active principle, and impairs the energy of action. It may be removed, as we have already stated, by expression: the residuary meal is drier and more energetic in its action. Cases occur frequently in which the application of a pure mustard-seed poultice might act too energetically. In such cases the mustard meal is mixed with a greater or less proportion of linseed meal, or the surface of a linseed-meal poultice is simply sprinkled over with mustard meal.

DISTILLED WATER OF MUSTARD.

Take of Mustard meal, 1 part.
Cold water, a sufficiency.

Let the mustard macerate in the cold water for several hours. Distil, and draw off 16 parts of product.

VOLATILE OIL OF MUSTARD.

This is prepared in the same way as the distilled water, with this difference simply, that a larger proportion of mustard meal is used. The distillation process is stopped when the water which passes over commences to taste almost insipid. The products of the distillation are collected in a small alembic, and distilled again to yield about one fourth of distillate. By this means a larger quantity of volatile oil is made to separate than would otherwise be the case.

MUSTARD REVULSIVE.

Take of Volatile oil of mustard, 1 part.
Alcohol of 66 C. (25° Cartier), 20 parts.

Mix, and filter.—(Fauré.)

This liquor causes a smart irritation on the

skin. A piece of fine flannel or fine linen is dipped into the liquor, and then applied to the skin. The linen or flannel may be moistened repeatedly. After two or three minutes' application the desired effect is produced. By a properly managed application of this means we may produce effects ranging from mere incipient redness of the part to blistering.

MUSTARD WINE.

Take of Crushed mustard seeds, 1 part.
White wine, 64 parts.

Let the seeds macerate in the wine for several days. Strain with expression, and filter.

The mustard imparts to the wine a hydrosulphuretted smell and pungent taste. The seeds must be used crushed, otherwise they would yield to the wine simply some of the mucilaginous parts of a feeble and disagreeable odour. The liquid is clear, because the albumen of the seeds coagulates and effects thus the clarification of the fluid, retaining more particularly the fixed oil, the presence of which in the filtered product would tend to impair very considerably the transparency of the latter.

DIURETIC BEER.

Take of Bruised mustard seeds,
Juniper berries, of each 2 parts.
Carrot seeds, 1 part.
Strong beer, 64 parts.

Let the seeds, &c., macerate in the beer for two days; strain.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

DESCRIPTION OF A NEW APPARATUS FOR PREPARING EXTRACTS.

By M. GRANVAL.*

The author, having a year before the reading of this paper exhibited a design for a new apparatus for preparing extracts of more uniform composition and strength, which received the approval of the society, submits in the present communication the observations he has made on his experiments.

The apparatus in question consists of two copper spherical vessels, tinned on their interior surfaces, each having two apertures suitable for the insertion of a tube, one of which is permanently furnished with a pipe constructed so as to receive a funnel, which is connected by a screw. These globes are each composed of two hemispheres, provided with projecting edges, which are pierced with holes to receive small screw-bolts, which, passing through them, are secured by a nut on the other side, and hold the two parts of the copper globe firmly together. A ring of caoutchouc is interposed between the approaching surfaces of the two copper hemispheres, and effectually excludes the passage of air.

Of the two apertures in each globe one is used to effect a vacuum; the other, permanently furnished with a small projecting pipe, is used to connect the two vessels by means of an extension of the tube. When a vacuum is to be created, water, as near the boiling point as possible, is poured into the first aperture, which is then closed with a stopper provided with a bent tube reaching to the bottom of the vessel; the water is then heated to ebullition. The vapour thus formed exerts a pressure on the liquid, and expels the quantity of water poured in less the vapour remaining which fills the vessels. Immediately this expulsion has been effected the tubes are withdrawn with the stoppers, and the orifices closed with solid stoppers, made air-tight with caoutchouc, and secured firmly. The funnel is now adapted to the projecting tube, and filled with the liquid to be concentrated. The tube is furnished with a stopcock, which enables the operator to command the supply of solution to the vessel, and to exclude the external air. When a sufficient quantity of the solution has entered, the cock is turned, and the concentration of the liquid may commence.

This operation is very easy, and, if it has been well done, the vessels are entirely discharged of air and filled solely with an atmosphere of vapour, the density and tension of which vary with the temperature. Thus while it is depressed the elastic force of the vapour is diminished, and it will condense in a corresponding proportion. If a diminution of temperature is sufficient to lower the tension of vapour it is easy to conceive that by placing the apparatus under certain conditions of temperature the liquid may pass from one vessel to the other with the greatest facility, and at all degrees. In fact, if we keep one of the vessels (that into which the liquor is to pass) at a constantly lower temperature than the other, and the interior tension of this part of the apparatus will be less than that of the warmer vessel, in this case, and in virtue of the principle of the equality of temperature between two spaces in communication, one part of the vapour contained in the warmer vessel will constantly and rapidly pass into the colder, where it will condense if a sufficiently powerful source of refrigeration is kept up.

Of all the classes of pharmaceutical preparations of which the physician requires to avail himself, extracts are among the most important; but it is nevertheless true that many of these have their utility considerably lessened by the fact that no means has been discovered of preparing them at all times perfectly identical, while the conditions under which only many of them can be obtained have a tendency to alter the principles on which their efficacy depends, so that a very slight modification of the process often determines great variations in the properties of the product. The alterations to which extracts are liable may be referred to two causes, the action of heat and of air. It has been long remarked that in general the extracts which are submitted to a prolonged ebullition lose their solubility, and that some of them, the action of which is very energetic when they are prepared with care, become by this excessive boiling quite inert. The extract of hemlock, taken in doses of a few decigrammes, is very dangerous when properly prepared, but when overboiled the same quantity may be taken without danger.

More recently M. Saussure has found by experiment that during the evaporation of extractive liquids the oxygen of the air is absorbed, and that carbonic acid is formed at their expense; and, further, that the oxygen and hydrogen arising from extractive matters from water, and that the alteration in the product, is in direct proportion to the duration of the operation and the elevation of the temperature.

Independent of the greater or less alteration which certain active principles undergo under the influence of heat and air, certain parts of these extracts may be wholly or in part eliminated, as the aroma of essential oils, certain acids, &c. These considerations may satisfy us of the importance of some means of withdrawing the extractive principles from the action of the two principal agents of their alteration, and at the same time separating them from their solvents. I hope the extracts which I have had the honour to submit will have satisfied you of the superior quality of the products of this process, and that the apparatus in question is capable of fulfilling all the conditions of efficient extraction. As to its principle there is nothing new about it; the sugar-refiner has long been familiar with the principle of working with a vacuum in the apparatus of Howard and others. But these contrivances are much too complicated to be employed in the preparation of a simple pharmaceutical extract; and even Barry's apparatus, reduced from the vacuum apparatus of Roth, and employed in certain laboratories, is too embarrassing for our purpose. On this account I hope that the arrangement now submitted, inexpensive and easy of management, will be of some utility in our art.

The extracts which I have made with this apparatus were, some of them, deprived of albumen, and made with the depurated juices of plants, or with the solutions obtained by treatment of their powders in a lixiviating apparatus; others retained their albumen, among which I may name the extractum aconiti. This extract has been prepared with the crude juice of the leaves of aconitum napellus. The evaporation was made at a temperature of 95-104° Fahrenheit.

The liquor received in the cool condensing vessel produced no reaction on vegetable colours, had little odour, and was entirely devoid of acridity. The latter circumstance leads to the inference that the extract contains the greater part of the volatile principle so characteristic of the whole family of ranunculaceæ, and of the genus aconitum more particularly. The extract possessed this last property in a very high degree, and was also remarkable for its thorough homogeneousness, and especially for its odour, which is exactly similar to that of the juice of the plant, and having no analogy with that which is common to the extract obtained in contact with the air. This remark is equally applicable to all the extracts which I have obtained by the same process, including those evaporated at a temperature of 158° Farheheit; which leads me to think that the odour common to extracts prepared in the usual way is due to the alteration which they undergo under the influence of air.

The extract of valerian was evaporated at a temperature of 104° Fahrenheit. The three first quarter portions of the liquid which came over did not affect the colour of litmus paper, but the fourth had a strong acid reaction. I found valerianic acid in it, nevertheless the extract had a strong odour, and had all the characteristics of a product of the first quality.

The extract of hemlock was made with the strained juice of the plant, and evaporated at a temperature of 122° Fahr. The product of distillation was not examined. The extract was remarkable for its nauseous odour, perfectly resembling that of the plant. Its taste is in striking contrast with the extract prepared in the water-bath. Conicine, which undergoes such rapid alteration in the air, is found in this extract to have suffered no injury or loss of substance.

The *Extractum Cinchonæ Siccum* was evaporated at a temperature of 158° Fahr. It is remarkably transparent, of a light colour, and has an odour exactly resembling that of powdered bark. The extract of ratanhia was prepared in the same manner as the preceding; it is of a fine ruby red, perfectly transparent and entirely soluble. A quantity of the same extract was purchased from one of the first houses in Paris, and treated with distilled water; it lost an insoluble residue amounting to 30 per cent. of the whole.

Extracts may be obtained by the aid of this apparatus, in a state of dryness, in a very brief space of time, without at all interfering with their transparence, by taking care that the difference of temperature in the two vessels is not too wide. If this point is neglected, the vapour, instead of rising from all parts of the vessel which is exposed to heat forms at the surface of the product as it does in the old method. The products, moreover, obtained in the ordinary manner are often full of bubbles, some formed by the carbonic acid gas and the vapour developed in the extractive mass, others by the air which enters when the product is stirred to accelerate concentration. The lowest temperature at which I have obtained extracts by this process is 95º F., but if it should be thought necessary or desirable in the case of particular products to concentrate them at a lower temperature, it can be easily done, since it is on the difference between the temperatures of the two vessels that concentration alone depends. The rapidity of evaporation is in direct ratio with this difference of temperature, but this rapidity is of course greater at a high than a low temperature, even when the difference between the heat of the two vessels remains the same according to Mariotte's law. The vapours

* Read at the meeting of the Pharmaceutical Association of Marne.

which are formed in the close vessel at a low temperature have little tension, and, accordingly, little density; and, therefore, to get the same quantity of liquids, we must condense a more considerable volume than when the pressure is stronger or the temperature higher, which is the same thing.

The results of our experiments may be thus summed up: — 1. Extracts prepared *in vacuo* at a low temperature represent the principles contained in the original substance much more faithfully than those made in contact with the air. 2. That it is proved to be quite practicable to obtain them at all times in a state of perfect identity as to chemical composition. 3. That this identity increases their value to the physician. 4. That, as vapours form much more rapidly *in vacuo* than in the air, extracts may by the former method be obtained in much less time even when evaporation takes place at a very low temperature, provided that a sufficient thermal difference be maintained in the evaporating and condensing vessels. 5. That, evaporation being effected without recourse to agitation, there is a saving of time and attention.—*Jour. de Pharm. et de Chim.*, Feb. 1849.

ON THE SOLID AND VOLATILE FATTY ACIDS OF COCOA-NUT OIL.

By A. GEORGEY.

M. Fehling, in his researches on the constituents of the cocoa-nut oil, has demonstrated the existence of caproic acid, $C_{12}\ H_{12}\ O_4$, and also of capryllic acid, $C_{16}\ H_{16}\ O_4$. The author's object was the discovery of the next in the series, capric acid, $C_{20}\ H_{20}\ O_4$, in this substance. For this purpose he saponified it with a dilute solution of potash, and decomposed the soap with weak sulphuric acid. The acid liquid when distilled furnished at first a milky product, after which the liquor collected in the receivers became clear, and separated entirely from the fat, which passed over at the same time. At this point the distillation was stopped, and the distilled acid liquid neutralized with potash. The soap obtained in this manner was purified by precipitation with chloride of sodium, redissolved in water, and decomposed with dilute sulphuric acid. A mixture of fatty acids, both liquid and solid, at the ordinary temperature was thus obtained floating upon the mother liquors as a layer of fat.

In this layer or mixture of acids the author sought for pichuric, capric, and caproic acids. The following was the method taken to isolate them:—The ammoniacal solution was decomposed with chloride of barium, the precipitate suspended in a large quantity of water and boiled. If the filtered liquid becomes turbid while still warm, and deposits light, bulky, white flakes, we may be sure that pichuric acid is present. But if, on the contrary, the precipitate only separates upon cooling in the form of a white, fine powder, there is proof positive of the presence of caproic acid. The pichurate of baryta is less soluble than the caprate, and is deposited before it. In this fact we have the means of separating these two salts, especially when operating with large quantities. The author first submitted these salts to repeated crystallization from water, and then from alcohol, and did not regard them as pure until perfectly accordant results were obtained in estimating the amount of baryta in the same salt, crystallized first from water and then from alcohol. In this manner M. Georgey was able to separate the caprate of baryta, $C_{20}\ H_{19}\ O_3$, and to confirm its composition. The capric acid separated from this salt by means of tartaric acid is solid at the ordinary temperature, and somewhat fatty to the touch. It melts at 86°; in the solid state it has a very faint hircine smell, which becomes stronger on melting. It is entirely soluble in boiling water, and separates as the solution cools in small crystalline laminæ. It forms a salt with oxide of silver, the composition of which is represented by the formula $C_{20}\ H_{19}\ O_3 + AgO$.

Capric acid exists in the cocoa-nut only in very small quantity. The author considers that the first principle of this vegetable fat is pichuric acid, the baryta salt of which, being less soluble than the caprate, is precipitated in the form of snowy-white bulky flakes. Pichuric acid is solid. When its concentrated solution is cooled to 32° it is obtained in warty masses, consisting of agglomerations of slender needles. The specific gravity of the solid acid is 0.883 at 68°. Its melting point is situate between 108° and 110°. Its composition is expressed by the formula $C_{24}\ H_{24}\ O_4$. It was checked by the analysis of the baryta salt, $C_{24}\ H_{23}\ O_3\ BaO$, and by that of pichuric ether, $C_{24}\ H_{23}\ O_3\ C_4\ H_5\ O$. After the soap from the butter of cocoa has been distilled with sulphuric acid a fixed residue remains in the retort; this consists of a mixture of fatty acids with high equivalents. After some experiments the author was led to infer the presence of myristic and palmitic acid. The butter of cocoa would thus contain:—

Caproic acid	$C_{12}\ H_{12}\ O_4$
Capryllic acid.....	$C_{16}\ H_{16}\ O_4$
Capric acid	$C_{20}\ H_{20}\ O_4$
Pichuric acid	$C_{24}\ H_{24}\ O_4$
And probably myristic acid	$C_{28}\ H_{28}\ O_4$
And palmitic acid	$C_{32}\ H_{32}\ O_4$

These results, the author remarks, are in direct opposition to those obtained by M. St. Evre in his investigations of cocinic acid. According to our author the cocinic acid of M. St. Evre, $C_{22}\ H_{22}\ O_4$, is a mixture of capric acid and of pichuric acid; its melting point is situated at 95°, nearly midway between those of capric and pichuric acids. The author has tried all the processes of purification applied to mixtures of the fatty acids of the cocoa-nut oil, and concludes that the only one which admits of pure products being obtained is that which consists in crystallizing the salts of baryta.—*Ann. der Chem. und Pharm.*, l. xvi., 298.

EXAMINATION OF THE OIL OF IMPERATORIA OSTRUTHIUM.

By M. H. HIRZEL.

This oil is obtained by distilling the plant with water; the layer of oil floating on the water is separated, and the water shaken with ether, as the oil is somewhat soluble in water. The oil is rectified with a little water, and dried with chloride of calcium.

It is without colour, limpid, very mobile, has an aromatic odour, and a burning taste. It inflames readily, and burns with a bright flame, giving off combustible smoke. It begins to boil at 338°, but with the prolonged application of heat the boiling point rises. Analysis of the dried oil gave:—

Carbon....	85.57	84.80	40	85.41
Hydrogen .	11.45	11.38	33	11.74
Oxygen ...	2.98	3.82	1	2.85

The boiling point not being constant, the oil was submitted to a fractionated distillation. That portion which passed over between 338° and 374° had the same composition as the original oil. On the other hand, the portion which distilled between 392° and 428° differed greatly from the pure oil; it possessed a more disagreeable quasi-empyreumatic odour, a slightly yellowish colour, and was richer in oxygen. The following was its composition:—

Carbon	81.74	30	81.08
Hydrogen.....	11.27	26	11.71
Oxygen.....	6.99	2	7.21

On distilling the oil with anhydrous phosphoric acid a perfectly trasparent, colourless liquid was obtained, having an aromatic taste and an odour like that of rosemary. The following was its composition:—

Carbon	87.76	10	88.23
Hydrogen.....	11.76	8	11.77

This hydrocarbon forms a compound with pure muriatic acid; it is prepared by passing pure muriatic gas into the oil until no more is absorbed. A reddish liquid is thus obtained, which is purified by distillation with water, and deprived of water by means of chloride of calcium. It forms in the pure state a liquid of agreeable odour and aromatic taste. It possessed the following composition:—

Carbon	74.98	30	75.00
Hydrogen.....	10.86	25	10.42
Chlorine	13.28	1	14.58

The oil absorbs chlorine with a very considerable evolution of heat and separation of muriatic acid gas. It forms a yellow, thick, oily liquid, heavier than water, having a peculiar smell and acrid taste.

On comparing the oil of imperatoria with the other essential oils it is found to exhibit considerable analogy with the isomeric essential oils possessing the formula $C_{10}\ H_8$, and is probably isomeric with those oils.

On this supposition the compound with muriatic acid is 3 ($C_{10}\ H_8$) + H Cl. Applying this view to the essential oil, it is further confirmed, for the rational formula, 4 ($C_{10}\ H_8$ + HO, and 3 ($C_{10}\ H^8$) + 2 HO may readily be derived from the empirical formula, $C_{40}\ H_{33}\ O$, and $C_{30}\ H_{26}\ O_2$. All these compounds would, therefore, be derived from the same hydrocarbon, and the oil of imperatoria would be a mixture of different hydrates and the same hydrocarbon ($C_{10}\ H_8$). This also explains the action of anhydrous phosphoric acid on the oil: the acid deprives the oil of the water of hydration, and isolates pure hydrocarbon. The oil of imperatoria is thus brought into the series of terebinthinae, which differ only in their capacity of saturation thus:—

Muriate of the oil of lemons, ($C_{10}\ H_8$) + H Cl.
" turpentine, 2 ($C_{10}\ H_8$) + H Cl.
" imperatoria, 3 ($C_{10}\ H_8$) + H Cl.
" neroli, 3 ($C_{10}\ H_8$) + 2 H Cl.

Pharm. Cent. Blatt., January.

CHEMICAL COMPOSITION OF THE FERRUGINOUS MINERAL WATERS OF THE DEPARTMENT OF THE LOWER SEINE.

By M. J. GIRARDIN, of Rouen.

The department of the Lower Seine possesses a tolerably large number of mineral springs, which are all, without exception, ferruginous.

M. Passy (Description géologique du Département de la Seine Inférieure) refers these springs to three different systems:—

Some of them come from the superficial chalk, and spring usually from a turfy ground resting upon plastic clay. Such are the springs of Aumale, Ry, Nointot, Rolleville, Rançon, Villequier, Oherville, Contremoulins, Valmont, Épinay.

Other springs from the Glauconite marl. To this class belong the springs of St. Paul and of the Maréquerie, at Rouen, and of Bléville, near Havre.

A third class spring from the ferruginous sands beneath the chalk formation, and which sands are at the surface of the soil in the district of the Bray. To this class belong the springs of Forges, Gournay, and of Quiévrecourt, near Neufchâtel.

All these springs have about the same composition. They owe their ferruginous properties to the presence of crenate and carbonate of iron.

We will here give the analyses of those springs only which had not been examined hitherto, referring to the "Essay on the Springs of the Lower Seine"* for the details relative to the divers sources which have been the object of anterior researches.

The springs of which we have to speak here are those of Valmont, Rolleville, Rançon, and of St. Paul and the Maréquerie.

VALMONT SPRING.

In 1843, M. Marchand, of Fécamp, analyzed at my request the ferruginous water of Valmont. In 1848 he repeated the analysis, principally with a view to ascertain whether copper and

* Précis de l'Académie des Sciences, Belles Lettres, et Arts de Rouen for 1848.

arsenic were present in the water. He obtained the following results; the quantity of the anayzed water being taken at one litre:—

Free carbonic acid, at the temperature of 59° Fahr., and under an atmospheric pressure of 760 millimetres (about 30)	0.766 litre.
Yellow coloured organic matter	quantity not determined.
A green resin, very soluble in alcohol, but only very sparingly so in ether	0.00087 grm.
Chloride of potassium	0.00949 "
" sodium	0.07297 "
" magnesium	traces
" calcium	0.00454 "
Nitrate of lime	0.00382 "
Sulphate of lime	0.01075 "
" potass	0.00465 "
Carbonate of magnesia	0.04514 "
" lime	0.28865 "
" ammonia	0.00227 "
Protocarbonate of iron	0.00558 "
Oxide of copper	traces
Silica	0.01260 "
Solid matters	0.46133 grm.

M. Marchand then analyzed 170 grammes of drained mud, representing 2,000 litres of the water, and containing 7.73 grammes of anhydrous peroxide of iron. He found a perceptible amount of copper, but could not detect the slightest trace of arsenic.

ROLLEVILLE SPRING.

A ferruginous spring rises at the base of a hillock near Rolleville (in the vicinity of Montivilliers). I examined this spring in 1846. I found that it contains the iron in the form of carbonate, creante, and apocrenate.

RANÇON SPRING.

At the commencement of the eighteenth century three ferruginous springs were discovered about three quarters of a league from Caudebec, in the valley of Brébecq or Rançon. The physicians of Rouen considered these springe as equally efficacious with those of Forges. At present there remains only one of these springs in exist ence. M. Preisser and myself analyzed this in 1842. One litre of the water left upon evaporation a residue weighing 0.258 grm., which, upon analysis, was found to consist of:—

Carbonate of lime	0.202 grm.
Sulphate of lime	0.015 "
Chloride of calcium	0.011 "
Chloride of magnesium	0.006 "
Carbonate and crenate of iron	0.024 "
Silica	traces.
Organic matter	
Crenic and apocrenic acids	
	0.258 grm.

FERRUGINOUS SPRINGS OF ROUEN.

These springs were discovered in 1603 by a gentleman of the name of Antoine, who was at the time equerry to the Duke of Montpensier. We find them mentioned in Professor Duval's "Hydrothérapeutique des Fontaines Médicinales Nouvellement Découvertes à Rouen" (1603).

There are two distinct springs; the one, in Martainville-street, is called Spring of the Maréquerie; the other, at the entrance of Rouen, St. Paul's Spring.

The analyses of these springs, or rather the chemical experiments made upon them by Néel, Cottard, Ledanois, Bois-Duval, De Nihell, Lechandelier, and Monnet were not sufficiently minute to show the true composition of these waters. Dubuc stated, in 1806, that these springs contain the iron in the form of carbonate (in the proportion of one grain per pint of the Maréquerie water), and the carbonate of iron is associated in them with hydrochlorate of lime, carbonate of lime, vegetable extractive, and carbonic acid.* In 1814 Vogel the elder disputed the accuracy of Dubuc's analysis, and asserted that the waters of the Maréquerie contain, besides carbonic acid, carbonates of lime and iron, sulphate of lime, and hydrochlorate of magnesia.*

In the year 1842 M. Preisser and myself analyzed both the springs of St. Paul and of the Maréquerie. We found per litre of water:—

	St. Paul. Grm.	Maréquerie. Grm.
Free carbonic acid	0.001	0.002
Silica	0.002	0.003
Carbonate and crenate of iron	0.069	0.094
Carbonate of lime	0.068	0.079
Carbonate of magnesia	..	0.011
Chloride of calcium	0.046	0.087
Chloride of magnesium.....	0.028	0.041
Sulphate of lime	0.008	0.012
Sulphate of magnesia.....	0.006	0.008
Sulphate of iron	traces	0.001
Sulphate of alumina	—	—
Bituminous organic matter, Crenic and apocrenic acids	0.002	0.007
Loss	0.003	—
	233	0.345

A series of researches which I made in 1848, to detect the presence of arsenic and copper in both or either of these springs, gave negative results.—*Journal de Pharmacie et de Chimie*, February, 1849.

ON THE ERRORS RESULTING FROM THE DETERMINATION OF THE SPECIFIC GRAVITIES OF BODIES WHEN IN A FINELY-DIVIDED STATE.

By Professor G. ROSE.

The author found, on repeating the determination of the specific gravity of some of the metals, that the results varied according to the state of division of the substance operated upon. This was the case with gold and silver, and similar results were obtained with platinum and sulphate of baryta.

Specific Gravity of Fused Gold.—These determinations are accompanied with great difficulties, as it is scarcely possible to obtain the gold in a suitable state. Native gold always contains silver, with slight traces of iron and copper; and, in the larger masses of native gold, quartz and brown iron ore are frequently enclosed. The purified gold, fused in crucibles, is always full of smaller or larger cavities, whether melted alone or beneath layers of borax, carbonate of soda, or chloride of sodium. When melted alone a large hole is found on the under surface if it solidified quickly, because fused gold occupies a much larger space than the solidified. Such a cavity frequently extends far beneath the surface, and in such case it is impossible to expel all the air. Moreover, the metal appears covered on the surface by frequent rows of very minute crystals, which intersect at an angle of 60°, and leave minute cavities between one another. If the fused gold is allowed to cool slowly, for instance, when melted in a porcelain furnace, its surface is found to be still more distinctly crystalline. If fused under a stratum the surface is, it is true, smooth and bright; but in this case deep cavities occur, which are filled with the flux. All these errors could only be avoided by determining the specific gravity of the metal, and of other metallic alloys, after they had passed through the pressing machine of the Mint.

At a temperature of 14° R. the author obtained the following numbers in his new experiments. Gold, fused in a clay crucible with borax and nitre, possessed a specific gravity of 19.2089; after it had been pressed, 19.3202, after being fused again in a black-lead crucible, 19.2908; and after repeated pressure, 19.3226. Since Marchand and Scheerer found that copper fused under a stratum of chloride of sodium possessed a higher specific gravity than when fused under other strata, a regulus was fused under a layer of chloride of sodium. Its specific gravity was 19.2722; after pressure, 19.2992; after fusion in a black-lead crucible, 19.2955; and after being pressed again, 19.3087. Gold, reduced by means of oxalic acid, and fused in a black-lead crucible, had a specific gravity of 19.2981; and after pressure, 19.3336. The fusion of gold under a layer of chloride of sodium did not afford the means, therefore, of obtaining gold of greater density; as it likewise remained lower after pressure, it appears as if the gold enclosed particles of chloride of sodium. Apparently that gold has the highest specific gravity which has been melted of itself in a black-lead crucible, and submitted to pressure. The author consequently assumes preliminarily 19.3336 as the specific gravity of gold at 14° R.

Specific Gravity of Silver.—Native silver cannot be employed to determine the specific gravity, because it is never pure; and that which has been purified cannot be melted alone for this purpose, because on cooling a portion is projected, and it puffs up more or less. The determinations made by Bresson are for this reason too low. In his former experiments the author weighed the regulus obtained on reducing the chloride, which answers very well. The earlier results with three different samples were:—I. 10 5041, II. 10.4991, III. 10.5036. In his recent experiments the regulus II. was fused in a clay crucible beneath a stratum of common salt. The regulus obtained was smooth on the upper surface, but reticulate on the lower one, and was consequently filed away at this place. Its specific gravity agreed with the results of the former experiments, being 10.5050 at 14° R.

Specific Gravity of Gold in the State of Powder.—Gold precipitated by protosulphate of iron from dilute solutions appears amorphous under a high magnifying power, on account of its minute state of division. From concentrated solutions it is precipitated in microscopic cubes. Gold reduced by oxalic acid appears in more distinct crystals; they are octahedrons. The metallic film deposited on the sides of the vessel in which the reduction is made consists entirely of such crystals. The results given below exhibit great differences, which can, however, only be ascribed to the nature of the precipitate, as several samples of the same precipitate afforded results which agreed with each other. The highest specific gravity was found in the finely-divided precipitates; for the larger the precipitated particles are, the lower the specific gravity. The specific gravity of gold, as precipitated by sulphate of iron, was found to be at 14° R. 19.5701, 19.7447, 19.8150, 20.6882, 20.2634. That precipitated with oxalic acid weighed likewise at 14° R. 19.4791; gold filings afforded at 16°.9 R. yielded the low specific gravity of 19.2178. Little globules, of about the size of a pin's head, fused before the blowpipe, likewise gave only 19.2721 at 18°.2 R. It is of no great consequence whether the surface of the metallic particles had been dried before immersing them in the water, as they are completely moistened when boiled with water. The precipitate which had given the above specific gravity of 19.5701 yielded, after drying and subsequent boiling with water, 19.5622; the dried precipitate, when pressed, possessed the specific gravity of 18.0194 only.

Specific Gravity of Silver in the State of Powder.—The silver employed by the author was precipitated from a solution of the nitrate by protosulphate of iron. The precipitate consisted of microscopic crystals, which were in general larger than in the case of the gold; they are octahedrons with truncated edges; they afforded at 14° the numbers 10.5485 and 10.6139. In this case also the lowest specific gravity was possessed by the coarsest precipitate.

Specific Gravity of Platinum in a State of Powder.—This is stated by Playfair and Joule to be 17.890. Liebig gives that of platinum-black at 17.572, 17.580, 16.1319. Platinum-black, prepared by Mitscherlich by precipitating chloride of platinum with carbonate of soda and sugar, and which appeared amorphous under the highest magnifying power, had the high specific gravity of 26.1418 at 14°; while that of platinum-foil, according to various determinations, is situated between 21 and 22.

Specific Gravity of Native Sulphate of Baryta,—

* "Annales de Chimie," vol. lviii., page 315.

* "Annales de Chimie," vol. lxxxix., page 105.

The specific gravity of a crystal from Silbach, in Westphalia, was 4.4875; another crystal, from the same locality, 4.4855; a crystal from Przibram, 4.4808; a crystal from Champeix in Auvergne, 4.4798; several fragments from the same locality, 4.4808; the largest of the latter, 4.4776 at 14° R. The heavy spar at Silbach afforded, according to an analysis made by Rammelsberg, 99.40 per cent. pure sulphate of baryta. The specific gravity of the sulphate of baryta, precipitated from the chloride by sulphuric acid, and which consisted of microscopic prisms, amounted at 14° R. to 4.5209 and 4.5350. Finely-pulverized native heavy spar from Champeix possessed a specific gravity of 4.48447; some from Dufton, 4.8027; both powders appeared very coarse under the microscope, in comparison with the precipitated salt.

Conclusions.—1. Determinations of the specific gravity of substances, obtained in a finely-divided state by precipitation, generally come out higher than when large crystals or solid masses are weighed. 2. In the first of these cases the specific gravity increases with the greater state of division of the precipitate. The reason of this is, that the increased surface of the body condenses more water upon it than upon a smaller one, precisely in the same manner as solid bodies act towards gases; consequently it is not only the body which is weighed in water, but at the same time also a surrounding stratum of denser water; and in this manner too low a number is obtained for the loss in water, which, on division into the absolute weight of the body, affords too high a result. Even though the water is but slightly compressible, yet to this circumstance must be opposed the very considerable power of condensation of finely-divided bodies, which is certainly great in specifically heavy bodies, bearing in mind that box-charcoal absorbs thirty-five times its volume of carbonic acid. Since the precipitated metals possess the same crystalline form as when fused, at least in the case of gold and silver, the higher specific gravity cannot be owing to the matter of the precipitated metal, and must consequently rather be sought for in the above causes. In the case of the sulphate of baryta the result is not quite so decisive, although even here the precipitated salt has a higher specific gravity, because it could not be determined whether the crystals of the precipitated salt were of the same form as the native. But that the gold filings and the pulverized heavy spar had not a higher specific gravity is probably owing to its being impossible to accomplish by mechanical means the requisite degree of division. To obviate the mischievous influence of cavities which occur in native minerals, it has become, since Beudant, generally the custom to use the powdered mineral for determining the specific gravity. According to the above experiments, there is no objection to this, as the state of pulverized substances can have but little influence on the specific gravity. The determinations in the case of chemical precipitates, which give erroneous results, are, from its being frequently impossible to obtain pure substances in any other manner than by precipitation from a solution, so important that the discovery of an accurate method for the determination of their specific gravities would be of great value.—*Poggendorff's Annalen* and *Chemical Gazette*.

ON THE PREPARATION OF SANTONIN.

By M. CALLOUD, the Elder,
of Annecci, in Savoy.

The difficulty to procure pure santonin is, in my opinion, altogether attributable to the presence of the blackish, resinoid, fatty matter which accompanies the santonin in the *semen-contra*, and is equally soluble in alcohol, which circumstance renders its separation a task of considerable difficulty. The results of many experiments have, however, clearly proved to me that by the judicious application of alcohol, commencing with weak alcohol, and increasing subsequently the strength of the agent, the operation will invariably succeed in producing a perfectly pure white and crystalline santonin. The method is most excellent, though, I willingly admit, rather tedious. In the course of my attempts to remove the latter objection I happened to hit upon a certain property of ammonia which enabled me at once to attain the end in view. Ammonia dissolves the fatty resinoïd matter of semen-contra without removing any notable quantity of the santonin. By taking advantage of this property of ammonia the process of obtaining santonin from semen-contra is considerably simplified, and the market price of that article may accordingly be much reduced.

The method by which I proceed is as follows:—

Take 10 kilogrammes of Aleppo semen-contra, 80 litres of water, and 600 grammes of quicklime, converted into lime-water (lac calcis). Mix the ingredients together, heat the mixture to boiling, and maintain it in ebullition until the solid matter is deposited at the bottom of the boiler.*

Strain now through a thin linen bag. (The rice bags of commerce answer the purpose admirably.) Pour the water which has been used to wash the boiler over the residue, and express strongly. Repeat the process of ebullition once or twice to ensure the complete removal of all soluble matters. The strained liquid deposits gradually the excess of the lime which has extracted the colouring matter of the semen-contra; it is accordingly necessary to filter again; but this time the straining-bag must be used. Collect the lime which you find on the strainer, and put it aside, as it contains still santonin.

Reduce the strained liquid by evaporation to 10 or 12 litres, and add common hydrochloric acid to the concentrated fluid. This agent dissolves the combination between the lime and the santonin, and sets the latter free. At the end of four to five days the impure santonin is deposited. The addition of the hydrochloric acid causes the formation of a blackish, pitchy matter at the surface of the liquid; this may be readily removed with a spatula.

When the santonin is deposited decant the acid liquid, and put it aside. Wash the deposit with one litre of hot water; filter and squeeze the residue in a linen cloth. Place the solid matter now in 500 grammes of liquor of ammonia. The resinoïd fatty matter which accompanies the santonin dissolves in the alkali, and may thus be readily separated from the santonin by straining the fluid through a cloth. Repeated washings with cold water remove the last traces of it.

The santonin is now no longer accompanied by any but inert matters, and all that remains to be done is to dissolve it in alcohol. To effect this boil the santonin for a few seconds with 3 litres of alcohol and a little ivory-black. Remove the vessel from the fire, permit the mechanically suspended parts to subside, and filter, making use of a double funnel, with the interval filled with hot water. Treat the deposit at the bottom of the vessel with a litre of boiling alcohol, and repeat the same operation once more. After the second boiling throw both the liquid and the deposit upon the filter.

The alcoholic solution deposits the santonin gradually in perfectly white, brilliant, crystalline tables, which are then dried on a piece of linen.

This new method of preparing santonin is simple in theory, and its practical application presents no serious difficulties.

In the preparation of santonin on a large scale, such as is carried on, for instance, in certain manufactures of chemical products in Germany, it is of importance to make use of all the residues, as they generally contain a sufficient quantity of santonin, to make the extraction of the latter an object of some interest to the manufacturer.

* Should the operator wish to obtain the volatile oil also, he must use a large alembic, distil the semen-contra first with the pure water, collect the product in the receiver, take off the helm, and add the lime-water to the mass in the still.

It is indispensable to boil the semen-contra two or three successive times with water, in order to effect the complete extraction of all soluble matter. But it would not be advantageous to treat the different waters separately by the process which we have just now indicated. It is more expeditious and profitable to boil a fresh supply of semen-contra in the waters of the second and third ebullition.

Add now the lime which you had put aside to the acid liquid which you had equally put aside. Add to the mixture hydrochloric acid in excess. Let the fluid stand at rest a few days, and decant the fluid (solution of chloride of calcium) off from the deposit. Wash the latter with warm water, dry it, and remove the resinoïd matter which accompanies the santonin by means of ammonia (120 to 150 grammes of liquor of ammonia) in the manner already described.

The deposit contains a large proportion of inert admixtures; it would not be expedient, therefore, to treat it at once with alcohol, since this would necessitate the use of a comparatively too large quantity of this fluid. The best way accordingly is to boil the deposit again in 8 litres of water mixed with 200 grammes of lime, to strain, to wash the deposit once or twice with boiling water, to evaporate the filtrate and washings until a thick pellicle forms at the surface of the fluid, and to decompose now by hydrochloric acid added in excess.

The acid solution deposits the santonin after forty-eight hours. Wash the deposit with water to remove the acid which might adhere to it. Dry the washed deposit, and dissolve it in the alcoholic mother liquors of the first process.

In the course of a day or two the alcoholic solution will deposit pure crystals of santonin.

Upon distilling the alcoholic mother liquors a considerable amount of santonin is left as residue; this santonin, however, is coloured, and requires purification.

I wished to ascertain the quantity of santonin carried off by the ammoniacal water. I therefore evaporated the latter; a blackish deposit was left, which contained a very slight proportion of santonin only.

The resinoïd matter remains in solution in the ammoniacal water; it is easy to precipitate it from this solution by the addition of an acid. Despite of the long series of operations which it has passed through, it still retains the acrid smell and taste of the semen-contra. I think this resinoïd matter claims a careful chemical and therapeutical study.

ON ASCLEPIONE.

By Dr. C. LIST.

Asclepias syriaca, it is well known, contains a white milky juice, which flows out in drops, from the incised or bruised locality, and is more abundant at the flowering period. This juice according to the author, who made repeated exe periments on it, consists of a peculiar crystallint body allied to the resins; he proposes to call i asclepione. The milky juice is highly concentrated, mawkish, has a slight acid reaction, and a faint smell like that of apricots. When it is heated its albumen coagulates, and encloses the particles of asclepione suspended in the juice so entirely that the liquid portion may be filtered quite clear. The asclepione is separated from the coagulum by digestion with ether. After most of the ether has been distilled off a perfectly clear solution remains, which on further evaporation solidifies to a crystilline mass. Asclepione thus prepared is not, however, pure: it contains a small quantity of another substance, which repeated treatment with anhydrous ether does not dissolve. Pure asclepione forms white crystilline masses in form like the cauliflower; on very slow evaporation it is obtained in concentric masses of radiated crystals. It is devoid of taste and smell, is insoluble in water and alcohol, soluble in ether, less so in oil of turpentine, naphtha, and concentrated acetic acid. A hot solution of caustic potash neither dissolved

nor altered it. It readily fuses, and then remains like lactucone, amorphous, and perfectly transparent. In consequence of this amorphous character it is most difficult to determine its melting point; repeated experiments showed this to be 219°; when further heated it becomes yellow and decomposes, giving an odour like that of heated caoutchoue. It cannot be sublimed. The substance dried at the ordinary temperature over sulphuric acid gave :—

Carbon	74.852	74.514	20	74 576
Hydrogen ..	10.767	10.452	17	10.532
Oxygen	14.381	15.034	3	14.892

If, as appears probable, both from its occurrence and properties, this substance is nearly allied to lactucone, the formula above given ought to be doubled, and its composition should be set down as $C_{40}\,H_{34}\,O_6$; that would represent it as isomeric with anhydrous camphoric acid.—*Liebig's Annalen*, January.

CALCINED MAGNESIA AN ANTIDOTE TO ARSENIC.

A young man, of Turin, had taken 6 decigrammes (about 10 grains) of arsenious acid dissolved in a small glassful of spring water. Symptoms of poisoning speedily manifested themselves, and became soon exceedingly alarming. The relatives of the young man sent for Dr. Garbigliotti. This physician intended at first to administer the hydrated peroxide of iron; but, being unable to procure on the instant recently-prepared hydrated peroxide of iron, he resolved to resort at once to the application of magnesia. He gave the patient 8 grammes of calcined magnesia in a small glassful of water, and repeated the same dose half an hour after. After the lapse of an hour part of the most alarming symptoms had disappeared: the pulse had recovered some force, the skin its natural warmth, the epigastric pains had completely vanished, and the face had resumed its natural expression. The patient had half an hour's sleep. Upon awakening he had a copious stool; the matters evacuated were blackish, sanguinolent, and excessively fetid. The next morning (the first symptoms had manifested themselves at ten o'clock on the preceding evening) the patient was quiet and composed, pulse high and vibrating. He complained simply of a burning sensation in the throat, great prostration of strength, and slight cramps in the lower extremities. At about ten o'clock in the morning he evacuated a small quantity of reddish, fetid, very thick and muddy excrements. A febrile reaction manifested itself, and lasted for three days, when the patient entered into convaleseence.

Assuming the peroxide of iron and the calcined magnesia to be equally efficacious in cases of poisoning by arsenic, Dr. Garbigliotti feels inclined to give the preference to the magnesia, on the one hand, because it can be most readily procured at all times, and, on the other hand, on account of its almost complete innocuousness, which permits its administration to almost any extent, whereas the hydrated peroxide of iron cannot well be given in very large doses.

The magnesia should not be very highly calcined however, since a high degree of calcination materially impairs its efficacy as an antidote to arsenic.*—*Giornale dell Academia di Turin.*

REMOVAL OF THE MARKS MADE IN LINEN WITH THE SO-CALLED INDELIBLE MARKING-INK.

By M. SOURISSEAU.

Immerse the marked linen in a bath of chlorinetted water until the silver is converted into chloride, which may be known from the white appearance which the marks assume. Rinse the linen now in river water, and wash it subsequently in ammoniated water, where the new-formed chloride of silver will speedily dissolve, and not the slightest trace of the inkstains will remain.

ON BLACK INK.

It frequently happens that the finest-looking ink turns yellow after some time. I was led to attribute this effect to an excess of sulphuric acid, which we find frequently in the sulphate of iron of commerce; upon this supposition I added to an ink prepared with commercial sulphate of iron liquor of ammonia (15 grammes of liquor of ammonia to 120 grammes of sulphate of iron contained in the ink). The result was such as fully to confirm my supposition. The colour of the ink, which previously to the addition of the ammonia used to turn yellow on paper after the lapse of some time, continued now to remain perfectly black.

* Dr. Lefèbvre, of Montdidier, reports a similar case of the successful application of magnesia in poisoning by arsenic.—*Journal de Chimie Médicale.*

THE THOROUGH DRAINING OF LAND.

By J. TOWERS, Esq., Croydon.

The very great importance of this operation begins to be understood, and it is highly probable that, were not pecuniary obstacles in the way, and the delicate problem of "tenant right" still unsolved, thousands of acres would, without much delay, be relieved from that volume of stagnant water which is perhaps the most mischievous of all the foes that the farmer has to contend with. In order to render this rather more apparent, we avail ourselves of a few of the material passages of an able article from a northern periodical which promises to take a very high position in the field of agriculture.

Draining is admitted to be the first step towards the improvement of soils, and of late years has been carried on to a great extent, but, as it would seem more by rote than by principle, the drain doctors have laid down laws for a universal system of draining, with about as much reason and effect as other doctors have attempted to cure all diseases by recommending a universal medicine.

Draining, to be completely effective, must be carried beyond the mere removal of water from places where it used to lie for days or weeks on the surface of the ground, for not only must all superfluous water be removed from the surface, but the superabundance of it which may remain in the soil, above what is absolutely necessary for the food of plants, must be removed also; and this not altogether to prevent satiety and repletion, but likewise to admit to their roots another species of food of equal importance—namely, air.

The access of air to the roots of plants is of as much importance as it is to the leaves; nay, probably of greater, for the roots feed on air, or gases, as much as do the leaves. But how is such aërial food to be admitted? Is it not by opening the ground in the operations of ploughing, trenching, digging, hoeing—by shallow planting, or by making shallow borders, so as to keep the roots within the reach of solar influence, and, consequently, to open it and its contents to a state fit for vital, attractive, absorption?

Nor is it in the removal of superfluous water, or the aëration provided for the roots of plants, that thorough drainage is to be deemed complete: the climate or temperature of the soil can, by such effective drainage, be improved and rendered warmer; and hence the precocity of all crops will be secured. Where no superabundant water exists to swamp, sodden, and chill the subsoil, the interstices between the particles of the ground, being open, admit the circulation of air and heat, either from above or below, whereas, otherwise, this circulation is completely prevented. Parkes has demonstrated this in the valuable Essay on the Philosophy of Draining, "Royal Agricultural Journal," vol. 5. This operation, if performed upon correct principles, secures three great objects, namely, carrying off superfluous water, tantamount to regulating the supply of aqueous food; the admission of air to the roots; and finally an improvement of the temperature of the soil, which thus also excites a natural stimulus to the two former which gives energy to the progressive development of the plants dependent upon the vital principle.

ON THE USE OF CHLORIDE OF GOLD IN DETERMINING THE PRESENCE OF ORGANIC MATTER IN SOLUTION IN ORDINARY WATERS.

By ALPH. DUPASQUIER.

The water of rivers, springs, wells, &c., all contain more or less organic matter in solution. When the quantity of this matter is very small, which is most frequently the case, its presence is unimportant, both as regards its use for domestic purposes and as applied to the arts. In this case the small quantity present may be considered as representing a normal state of the water, the quantity being so small that it is only taken into account in a qualitative examination of the water.

But common waters are frequently found to contain organic matter to an extent which may be represented as abnormal, and in these cases they are sometimes rendered unfit for use. It is therefore of some importance to ascertain, by means of a simple and easy process, the presence of organic matter in water, when it exists in more than usual proportion. In numerous experiments on drinkable waters I have found that testing by nitrate of silver gives but uncertain and false results. As regards the evaporation to dryness, and the calcination of the residue, which becomes blackish when the organic matter is in some quantity, it is a long process, and the results but unsatisfactory.

After having tried without success various chemical processes to detect the presence of this abnormal proportion of organic matter in waters, I found that the use of chloride of gold answered the purpose most efficiently, giving results which may be considered as decisive and certain.

The employment of chloride of gold suggested itself to me from the remarks made by persons engaged in the daguerreotype process, and communicated to me by M. Glenard, to the effect that chloride of gold was decomposed when water condensed in steam-engines, or other distilled water containing organic matter, was used for its solution.

The following is the process by means of which I ascertained the abnormal proportion of organic matter contained in the water. An ounce or two of the water to be examined is to be poured into a small flask, and a few drops of solution of chloride of gold added sufficient to colour it slightly yellow: the liquid is then to be boiled. If the water contains but the quantity of organic matter usually present in drinkable waters, it will retain the yellow colour, which remains pure, even during prolonged ebullition. If, on the contrary, the water should contain an abnormal proportion of organic matter, it will in the first instance become brownish, and afterwards assume a violet or bluish tint, which arises from the decomposition of the salts of gold by the organic matter.

If the proportion of organic matter be large, the violet or bluish tint becomes more decided on prolonged ebullition; but a slight brownish or greenish coloration of the liquid proves only that the organic matter exists in larger proportions than is usual.

In making these experiments with the chloride of gold, it is most essential to use a solution of this salt without an excess of hydrochloric acid, as I have ascertained that the latter counteracts the decomposing action of the organic matter.

Frequently, during a prolonged ebullition of the water coloured by the metallic chloride, oxide of gold is precipitated, owing to the action of carbonate of lime on this salt. In this case, if there is not much chloride of gold present, the liquid may become colourless, or, if the proportion contained be large, the yellowish tints may be modified by a slight turbidity of the liquid.

In order to distinguish these effects from the decomposing reaction produced by the organic matter, one or two drops of pure hydrochloric acid may be added, which will immediately dissolve the oxide of gold, and the liquid will then reassume its original appearance, if there has been no decomposition of the pure salts by the organic matter. But if the chloride of gold has been brought to the metallic state under the influence of the organic matter it does not dissolve in hydrochloric acid, as does the oxide, and the liquid remains of a violet, bluish-violet, brownish-violet, or greenish colour when there is rather a large excess of chloride of gold. Notwithstanding, if the water contains a trace of a nitrate, and is reboiled, the gold may then be dissolved.

This process has been objected to by some, on the ground that all organic matters have not an equal decomposing action on the salt of gold. But this objection is of no importance, when it is considered that it relates only to the organic matter contained in natural waters, which is always of the nature of ulmine or geine, and evidently results from the washing of vegetable or animal matter in a more or less advanced stage of decomposition, and most frequently in the state of mould, which exists in the earth through which the rain water filters, or in the soil of towns watered by rivers which supply their wells and fountains.

Under all these circumstances the water contains organic matter of a similar nature, resulting from infiltration, and this exerts a marked decomposing influence on the salt of gold.

I have made numerous experiments with distilled water, to which I added either some recent urine, some gelatine, some crumb of bread, or any organic matter unaltered by putrefaction. These substances generally decompose the salt of gold, but most frequently after very prolonged ebullition. I have also boiled a small quantity of peat in the distilled water, and in another experiment a small portion of vegetable earth; the liquid when filtered, then treated by the chloride of gold, rapidly became of a violet or bluish colour.

These comparative experiments have thus shown that the chloride of gold may be decomposed by unaltered organic matters, but in general with more difficulty than by those which result from spontaneous decomposition of animal or vegetable remains, and, consequently, analogous to the organic matter held in solution in natural or common waters.—*Journ. de Pharm.* and *Pharmaceutical Journal.*

THE CHEMICAL TIMES.

SATURDAY, MARCH 10, 1849.

THE SPHEROÏDAL STATE OF BODIES.

We beg to call the attention of our readers to the marvellous experiments of M. Boutigny, of Evreux, on the spheroïdal state of bodies, of which we intend shortly to give a detailed account, and which appears to have excited the greatest enthusiasm in the scientific world of France.

One of these experiments more particularly is most remarkable. A platinum capsule is placed in a crucible, heated to whiteness, in an assay-furnace. When the capsule is red hot, a few drops of liquid sulphurous acid are poured into it, and the crucible, with the capsule, is replaced in the furnace. Now, surely, considering that sulphurous acid is a gas which requires for its liquefaction a high degree of cold and an enormous pressure, which boils at 12.2 Fahrenheit, and can be prevented, with the greatest difficulty only, and by keeping it in tubes hermetically closed by fusion in the lamp from reassuming the gaseous state, one would think that a formidable explosion would immediately ensue. But, so far from any phenomenon of the kind taking place, the liquid not only does not boil, and volatilizes hardly in the capsule, though under the influence of a heat sufficiently intense to fuse most metals, but, if the weather happen to be at all moist, the almost white-hot capsule is actually found to retain still a fragment of most intensely cold ice!

The other liquefied gases comport themselves similarly.

Now, upon what principle does this most marvellous phenomenon depend? This is a problem which remains to be solved. M. Moigno has suggested a most ingenious solution, which, moreover, in our opinion, seems based upon the soundest and most rational principles. M. Moigno takes his stand simply upon the great principle enunciated by Newton, viz., that the reaction corresponds to the action of the force or power in proportion to the resistance. This principle, and its immense bearings and consequences, M. Moigno contends are not sufficiently understood by even the most eminent physicists of the present day. According to this principle, correctly understood, the action of a force cannot manifest itself in presence of a proportionately too feeble resistance. Upon this assumption the fact that the immense amount of heat proceeding from the white-hot crucible fails to disassociate the molecules of the small liquid drop may at once be most readily accounted for. It is precisely because the calorie current is too strong, and its immense power placed in presence of a resistance which is almost *nil*, that it produces no sensible effect. Lower gradually the temperature of the crucible, and you will find that as soon as the calorific current is reduced to a state of less intensity, and more proportionate to the resistance opposed to its action by the feeble cohesion of the molecules, the latter will suddenly solve their connection, a loud explosion will ensue, and the liquid will at once, and suddenly, be converted into vapour. Or, instead of lowering the temperature of the crucible, augment the quantity of liquid and increase thus the power of resistance. Immediately the force of the caloric current, inert up to that time from its very excess, will commence to act, and cause a sudden vaporization of the liquid, attended with a terrific explosion.

Such are M. Moigno's views on this most interesting subject.

It appears that M. Boutigny's researches on the spheroïdal state of bodies have already led in France to some important practical applications. Among others, M. Testud de Beauregard has constructed a steam-engine seemingly upon a similar interpretation of the cause of the phenomena observed by M. Boutigny to that suggested by M. Moigno, and which we have just now briefly explained. It is expected that the invention of this new engine will form a new era in the history of steam.

A series of researches on the phenomena displayed by bodies in the spheroïdal state, by Professor Faraday or Professor Grove, or some other eminent British physicist, would indeed be a great boon to science, and probably equally so to the arts.

THE CHOLERA.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
Cases already reported:—				
In London and vicinity...	1163	600	135	428
In the country	975	423	162	390
In Scotland	11731	5086	4030	2615
Total	13869	6109	4327	3433

Fresh cases reported the 7th of March, 1849:—In London and vicinity, viz.:—Bethnal-green Lunatic Asylum—number of cases, 1. Schacklewell—number of cases, 1; recovery, 1. Shepherd's-bush—number of cases, 2; death, 1.

In Scotland, viz.:—Glasgow—number of cases, 1; death, 1; recoveries, 15. Riccarton—number of cases, 1; recoveries, 10. Kilburnie—number of cases, 2; death, 1. Auchinleck—number of cases, 5; deaths, 3; recoveries, 5. Charlestown, Dunfermline—number of cases, 10; deaths, 8. Dunfermline—number of cases, 3; death, 1.

Total new cases, 26; deaths, 15; recoveries, 22.

BIRTHS AND DEATHS IN LONDON DURING THE WEEK ENDING MARCH 3.

The account published by authority of the Registrar-General, for the week ending Saturday last, shows the births in London to amount to 1,547, and the deaths to 1,138. The 1,138 deaths are 31 below the winter average, and show a decline on the previous week of 53. Hooping cough has become unusually fatal. The deaths from diarrhœa and dysentery, which seem to have been on the increase at this season during the last three or four years, were 23, the average being 14; those from cholera were 35. The mortality from smallpox and measles is unusually low; that from typhus has fallen to the average, and is less than has been observed for a long period. The mortality from bronchitis is near the average, while pneumonia was fatal only to 81, which is 22 below the average.

The fatal cases of cholera registered in the week ending Saturday, March 3, are these:—

Kensington; St. Paul's, Hammersmith.—At Shepherd's-bush, M. 51, "cholera (4 days);" at the same place, F. 4, "cholera (7 hours)." Mr. Roy, the registrar, states that "the above occurred in a row of eight cottages on the Uxbridge-road, which are inhabited by the families of labourers, of whom some appear to be in great destitution. The locality is swampy, badly drained, and has some stagnant ditches. In the rear of the cottages, at the distance of twenty-five feet, is a foul ditch, into which a quantity of nuisance is emptied; and before it was cleaned out it contained about two feet of black offensive matter. Representations, personal and by memorial, have been more than once made to the commissioners of sewers, under whose jurisdiction the neighbourhood is, but no attention has been paid hitherto. Other cases are now under treatment, and some of them present very unfavourable symptoms." Town.—In James-street, wife of a labourer, 28, "cholera Asiatica (14 hours)." In same street, wife of a hawker, 58, "diarrhœa (3 days), cholera." In same street, widow of a labourer, 68, "cholera (14 hours)."

Chelsea; South.—M. 79, "diarrhœa (5 hours), cholera morbus (15 hours)," p.m.

Hackney; Hackney.—F. 79, "debility succeeding spasmodic cholera (7 days); collapse."

South.—M. 23, "natural death from cholera (48 hours)." Inquest.

Shoreditch, St. Leonard's.—An artist, 48, "cholera (3 days), low fever (2 days)." No probable cause of attack can be discovered. At 31, Hoxton-square, daughter of the above artist, 6, "cholera (16 hours)." The deceased belonged to a very respectable family, and possessed every comfort. The two following cases occurred in the Female Refuge for the Destitute:—F., servant, 14, "diarrhœa (2 days), Asiatic cholera (5 days)." F., servant, 14, "Asiatic cholera (6 days)."

Bethnal-green; the Green.—M. 27, "cholera (7 days)." M. 4 months, "cholera (5 days)." F. 30, "cholera (5 days)." F. 18, "cholera (9 days)." F. 11 months, "cholera (4 days)." The six following cases occurred in Messrs. Warburton's Lunatic Asylum:—F. 28, "mania, cholera (6 days);" F. 70, "mania, cholera (7 days);" F. 54, "mania, cholera (28 hours);" F. 70, "mania, cholera (24 hours);" F. 70, "mania, cholera (55 hours);" F. 33, "mania, diarrhœa (12 hours), collapse (108 hours)." Town.—At 10, Little George-street, son of a chandler, 4, "epidemic cholera (3 days);" at 2, Nelson-street, son of a general dealer, 3, "diseased brain (2 months), malignant cholera (3 days)."

Whitechapel, Goodman's-fields.—At the Cholera Hospital, 88, Leman-street, son of a labourer, 11, "Asiatic cholera;" at same hospital, F. servant, 38, "Asiatic cholera." Aldgate.—In the Tower of London, M. 5, "cholera (15 hours)." A healthy situation.

St. George-in-the-East; St. Paul.—On March 1, at the parish cholera-house, a mariner, 23, "cholera Asiatica (3 days), premonitory symptoms (1 day), collapse (3 days), no cramps in extremities;" at same house, a pauper from the workhouse, F. 55, "cholera (10 hours)."

Poplar, Bow and Bromley.—F. 1, "Asiatic cholera (24 hours)." The above occurred at Old Ford, Bow, adjoining the river Lea, in a factory-yard. Almost every case of cholera in Bow has occurred in this neighbourhood. A labourer at a distillery in Bromley, 36, "natural death, sudden of Asiatic cholera (12 hours)," inquest. Deceased resided in one of the streets which have been referred to before as being very deficient in drainage. At Grove-hall Lunatic Asylum, M. 14, "natural death, sudden from cholera (2 hours)," inquest.

St. George, Southwark; Kent-road.—M. 37, "cholera maligna (30 hours)."

Rotherhithe; Rotherhithe.—F. 38, "cholera (3 days)."

Greenwich; Greenwich West.—In Dreadnought Hospital, M. 26, "typhus (2 weeks), cholera (3 days)."

CITY COMMISSIONERS OF SEWERS.

On Tuesday, the 6th inst., the commissioners assembled for the transaction of general business.

SANITARY MATTERS.

The inspectors reported a vast number of houses and localities wherein they had served personal notices for compelling the owners to drain the same into the public sewers, according to the terms of the act of Parliament, and for arranging and improving the internal drainage and cleanliness thereof, and also for enforcing the laying on of water to the water-closets, &c. It was also reported that the further attention of the board should be called to the fact that, the public companies and the royal hospitals of London being owners of considerable property in the city, it was desirable that such proprietors should receive notice of the compulsory power of the board in regard to the drainage, internal and external, of the same.

It was ordered, that the clerk should write to all the parties interested, calling upon them to improve the drainage of all the property over which they had control respectively.

The clerk read to the court a letter from the commissioner of police, containing a list of the number of nuisances reported to him by the officers of his force as existing in various parts of the city. The report, which referred to the nuisances detected since the last monthly report was made by the commissioner, was referred to the Board of Health. The letter of the commissioner drew forth some remarks from the members, disapproving the idea entertained by Mr. D. W. Harvey that the police were the most available channel through which the sanitary condition of the city could be improved, the objectors considering that the commissioners of sewers were, under the act of Parliament, alone authorized to carry out the views of the Legislature in that respect. They at the same time expressed their feelings that the police might be very useful in assisting the officers of the court by intimatinng what came under their notice in the course of the performance of their duties.

The court then adjourned.

MISCELLANEOUS CORRESPONDENCE.

A SIMPLE AND EXPEDITIOUS METHOD OF TAKING THE SPECIFIC GRAVITIES OF LIQUIDS AND POWDERS.

[To the Editor of the Chemical Times.]

Sir,—The following method of taking specific gravities I have not seen given for that purpose, and, as it is simple and expeditious, I beg to call your attention to it. It is more especially applicable to powders soluble or insoluble in water, and to oils, spirits, or solutions:—

The apparatus is a tube capable of holding rather more than 200 grains of water, and accurately divided from 200 into hundreds, tens, and grains, on a scale marked upon it.

To take the specific gravity of a fixed or volatile oil the tube is balanced by sand or shot on a balance. An indeterminate quantity of the oil is poured in and weighed. The specific gravity is got by calculation, thus:—Suppose 114 grs. have been weighed in the tube, and that it measures on the scale 123 grs., then 123 grs. of water is to 114 grs. (the same bulk) of oil as 1.000 is to the specific gravity, or 0.927.

For an insoluble powder a quantity of water is put into the tube and balanced; the height of the water is noticed, and a quantity of the powder now poured in; this is weighed, and the height of the water is again noticed. The calculation is the same as before, only deducting the bulk of water in the tube at first from the whole bulk thus:—Suppose when the tube was balanced there was 50 of water in it by the scale, 152 of the powder by weight put in, and that the surface of the water above the powder is at 184 on the scale, then 184 less 50 = 134 is the weight of a bulk of water corresponding to 152 of the powder, or 134 is to 152 as 1.000 is to 1.113 = the specific gravity.

For a powder soluble in water another liquid is substituted in which it is not soluble, such as turpentine, alcohol, or oil. This is exactly the same as if water was used, namely, balance the tube with the turpentine or oil in it, notice the height it stands on the scale, pour in the powder, weigh, and again read off the height of the surface of the liquid. Deducting the bulk of the oil or turpentine from the whole bulk gives the weight of a bulk of water equal to the known weight of the substance used.

For a powder lighter than water, but heavier than turpentine or ether, these can be substituted for the water, and the calculation will be the same as in the last.

The specific gravity of a liquid at a certain heat can also be easily ascertained by this tube, thus:—Balance the tube and (supposing a fixed oil is the liquid) pour in a quantity, and weigh; heat it now to the desired temperature, and notice its bulk on the scale, the calculation is the same as in the first example given. It is evident hot powders can be done in a similar way by heating a fixed oil to the desired temperature in the tube (previously balanced with this oil in it), and noticing the bulk; now put in the powder, weigh, and heat again to the same temperature, and notice the bulk; the calculation is the same as in the second example.

This tube can be put to so many purposes in ascertaining specific gravities, and it is so simple and easily managed, that to some of your many readers, I doubt not, it will prove acceptable.

If the tube was increased so that about 1,000 grains of the substances could be weighed in it, then it would be more exact in its results; but this would necessarily make it very long if the grains are to be distinctly marked upon it, and, therefore, not so easily weighed and cleaned out. E. M.

Glasgow, March 6, 1849.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

David Newton, of Macclesfield, in the county of Chester, merchant, for certain improvements in the application of glass and glazed surfaces to nautical, architectural, and other similar purposes. Patent dated August 7th, 1848. Enrolled February 7th, 1849.

This invention relates to the application and adaptation of glass to a variety of purposes for which it has not been used hitherto. In the first place the patentee proposes to apply glass, either colourless or coloured, to nautical purposes, viz., to form caps or terminals for the masts of vessels; in which capacity it serves the double purpose of a repellent of electric fluid, and a telescopic object of sight in the horizon. He also proposes to apply these caps to the ends of the yards and spars, and thus to protect ships from the destructive influence of lightning. When intended to serve as an object of sight, these caps are made hollow, and of considerable size, having a hole in the side to admit of the free expansion and contraction of the air.

Secondly. This invention relates to the application of glass or glazed surfaces in architecture, either for actual utility or ornament; its decorative properties depending on the variety and combination of colours. Colourless glass may be backed with foil or some other reflecting or non-reflecting material. It may be used with advantage instead of carved wood, plaster, or other similar ornaments. Glass is also adapted for ornaments of a stalactite character. The colours of the glass used for these various purposes depend upon the nature of the subject for which it is intended to be used; for instance, gold-coloured glass may be advantageously used in imitation of gilt work, which will be less expensive than the present mode of gilding, and, moreover, not liable to tarnish.

The third part relates to the application of glass to the keys of what are usually termed the accidental notes, in pianos, seraphines, or organs, which keys are commonly made of ebony. The glass keys may be coloured or otherwise ornamented. As a further improvement in these instruments, the patentee employs glass legs for their support, such supports isolating the instruments, and consequently improving their tone.

The fourth improvement is the application and adaptation of glass, as a material for the casting of letters to mark the names of streets, &c. These letters may be either placed in relief or imbedded in gutta percha, or some other suitable material, and backed with foil, or some other coloured or reflecting material.

The fifth part refers to the application of glass in the manufacture of signs or emblems of trade or profession.

Alonzo Buonaparte Woodcock, of Manchester, for improvements in steam-engines, and in apparatus for raising, forcing, and conveying water and other fluids. Patent dated August 22d, 1848. Enrolled February 22d, 1849.

This specification describes a novel mode of packing the pistons of steam-engines, buckets of

air and water pumps, and piston and pump-rod stuffing-boxes. The mode of packing proposed by the patentee consists in the employment of a ring of permanently elastic material, in lieu of the ordinary packing; this ring is pressed between the exterior surface of the piston or bucket and the interior surface of the cylinder, thus forming steam-air-and-water-tight joints, upon the motion of the piston up or down the cylinder. The elastic packing-ring is caused to revolve upon its own centre; and thus its surface does not slide upon the surface of the cylinder, but has a rolling motion upon it as well as upon the piston. In his specification the patentee illustrates by engravings the application of the principle to the lifting pump and shut-off cock, or valve. The ring is formed of some permanently elastic material—the patentee preferring the employment of vulcanized indiarubber for the purpose, in consequence of its retaining its elastic state permanently at considerably high degrees of temperature. The cross section of the ring is that of a cylinder or circle. Other forms of section may be used, but the patentee prefers the cylindrical as best adapted to the purpose. The interior diameter of the ring is less than the exterior diameter of the piston or bucket to which it is to be applied, so that it is necessary to stretch and extend it, to enable it to be placed upon the piston; and the exterior of the ring is less than the interior diameter of the cylinder, so that it becomes necessary to contract the ring. When placed in the cylinder it assumes the elliptical shape by reason of its being compressed between the piston or bucket, and the barrel or cylinder. This compression and the elastic nature of the ring form an effectual water-tight joint, both upon the surface of the piston and the surface of the cylinder. Upon any upward or downward motion of the bucket or piston within the cylinder or barrel, the elastic packing-ring revolves upon its own centre likewise, up or down the cylinder in the same direction as the movement of the bucket; but, in consequence of its compressed state, always preserving contact both with the bucket and the cylinder. This construction of packing, and its mode of action, produce but a small amount of friction compared with the ordinary mode of packing, where it is forced with a great degree of pressure against the surface of the cylinder, necessary to form a water-tight joint; the friction of the rubbing surfaces in contact when in motion being very considerable. The patentee mentions other advantages attending his mode of packing; he states that it is not absolutely necessary that the interior of the cylinder should be accurately bored out, or indeed bored out at all, as it may be left rough as it leaves the foundry; the elastic nature and the rolling action of the packing effectually preserving the joint air-tight. Where there is considerable force or pressure to be overcome, as in the piston of a steam-engine, or the bucket of a forcing-pump, the patentee proposes to make the packing-rings of solid elastic material, as being better calculated to resist that pressure; but when the pressure is only light, as with the common lift-pump or air-pump, the patentee proposes to make the elastic rings hollow, filling the cavities with air, in order to render them more elastic. The patentee proposes the application of it to valves, cocks, taps, and other apparatus employed for the passage of fluids.

The patentee proposes its application likewise to stuffing-boxes for steam-engines, piston-rods, pump-rods, and other similar apparatus; he also proposes to construct cylinders or barrels of pneumatic and hydraulic machines wholly of some permanently elastic material, or line them with some elastic material, the piston or bucket being either constructed as before described (with rolling elastic packing), or made of some smooth hard substance, as glass or porcelain, the edges being rounded to present a curved surface to the interior surface of the elastic cylinder or elastic lining.

The patentee claims, firstly, the application to the pistons and stuffing-boxes of steam-engines and other similar apparatus of one or more rings of a cylindrical or other suitable form, and of any suitable material permanently elastic; such rings acting as a rolling packing, as described.

Secondly. The application of one or more rings of material permanently elastic as a rolling packing to the pistons and buckets of pumps and other apparatus for raising or forcing water or other fluid, as described.

Thirdly. The application of one or more rings of permanently elastic material as a rolling packing to valves, cocks, taps, or other similar apparatus, for the conveyance or passage of water or other fluids.

Fourthly. The lining the barrels or cylinders of pneumatic or hydraulic engines and machines with vulcanized indiarubber or other elastic material, as also the constructing such barrels or cylinders wholly of such elastic materials, as described.

William Young, of Queen-street, Cheapside, lamp-manufacturer, for improvements in closing spirit and other cans or vessels. Patent dated August 21st, 1848. Enrolled February 21st, 1848.

The improvement in closing or stopping the orifice of cans for containing spirits consists in forming the orifice in the brass mouthpiece with which cans for holding camphine and other similar spirits are usually furnished, of a smaller diameter towards the interior, producing thus a shoulder, against which the end of the cork or other elastic stopper comes in contact when inserted; the mouthpiece having a screw on the exterior, upon which a screw cap is fitted for the purpose of forcing the cork into its seat, and by which it is so compressed as to effectually close the orifice and render any escape of spirit impossible. The screw-cap is made with a hole in the centre, in order to show the cork, and thus to prevent the chance of securing the cap without first introducing the elastic stopper.

The second part refers to the securing of cases containing spirit-cans, for carriage or otherwise. This consists of a square tin canister, suitable for holding four or more of such cans, and furnished with a hinged lid, having on the opposite side to the hinge a small bracket on the inside of the case; this bracket supports a short threaded pin, which, when the lid is closed, receives a screw-cap fitted to the lid, so that it may be held fast, at the same time allowing free movement for the purpose of screwing it on. This lattter operation is effected by a key fitting a pin on the cap, which is so recessed into the lid as to render the use of such instrument necessary. This recess is afterwards filled with wax, and an impression made thereon, so as to prevent the possibility of the case being opened without detection.

The third part refers to the retaining of corks in ordinary glass or other bottles, which is effected by means of a disc of metal received into a groove formed in the neck near the orifice. These metal discs are formed with a hole in the centre, for the introduction of a corkscrew or other instrument for extracting the cork when required; they have a cut from one side to the centre, and are when manufactured raised in the form of a cone, in order to reduce their diameter. The cork having been introduced into the bottle neck is forced below the groove, when the disc, as raised in the form of a cone, is placed above, and, being of thin sheet metal, a slight pressure in the centre serves to flatten it out, causing it to expand; and the edge entering the groove prevents the cork being withdrawn without sufficient force to double up the edge of the metal disc so as to withdraw it from the groove.

The fourth mode of closing or stopping bottles consists in forming bottles with a transverse aperture in the neck or mouth, in addition to the ordinary passage, such transverse opening being of a larger diameter than the other, so that the introduction of a cork or other stopper in that direction will effectually close the bottle.

The next improvement consists of a bung, or other similar stopper for large openings, which is made of wood, with a circumference of cork or other elastic material, which being capable of compression produces a more effectual plug or stopper for such purposes; the ring of cork is received against a shoulder, the circumference not being removed to the whole thickness of the bung. A somewhat similar contrivance is also represented for closing the necks of bottles, which is fitted on in the manner of a cap, the cork or other elastic material constituting a lining to the wood cap, by which a temporary closing is readily effected.

The next part refers to the attaching the glass vessel or receiver to the stem of camphine lamps, in such manner as to render them spirit-tight. In the lower part of the receiver a recess is formed for the reception of a ring of cork, which is pressed upwards by a screwed flange on the stem, the receiver abutting against a fixed flange on the stem. The cork or other elastic material is compressed within the recess in the bottom of the receiver, by which it is thus rendered perfectly tight.

Another improvement consists in the mode of forming a sliding joint in tubes, by means of a socket placed on the end of the larger tube, and which receives the smaller tube to be so jointed. The socket is fitted with a screwed cap, by which a body of elastic material is compressed within the socket, so as to surround the smaller tube, and render such joint perfectly impervious, at the same time permitting it being slid out or in, as may be required.

A method of connecting glass tubes is represented, in which the ends to be connected are made similar to the ordinary socket-pipe for street purposes, where the end of one pipe is received by a socket on the other, of a sufficient diameter to receive a thickness of vulcanized indiarubber or other suitable material, which is forced in so as to fill the cavity; the two pipes being prevented from separating by wood pins passed through from the exterior of the socket, the points being received in a groove formed by a contraction at that part of the other pipe.

The last of these improvements consists of a machine for rolling and compressing corks, so as to equalize the grain, and render them better adapted for the purpose. A bed or slab of wood is fitted at one end with a standard supporting a roller across the bed, and so arranged that it can be adjusted at various heights. One end of a long piece of wood is placed under the roller, the other being furnished with a handle, by which it is held. The cork to be operated upon is placed between the bed and the piece having the handle, on which a sufficient degree of pressure is exerted, at the same time passing it to and fro under the roller, by which the cork will be rolled between the two surfaces, this treatment rendering it more equally elastic. By placing the cork nearer and farther from the roller a greater or less degree of leverage will be obtained.

The claims, which are a dozen in number, are for the described modes of constructing the various parts, so as to effect the several objects in view, as set forth in the specification.

PATENTS RECENTLY GRANTED.

ENGLISH PATENTS FOR THE WEEK ENDING FEBRUARY 28TH, 1849.

Clement Augustus Kurtz, of Wandsworth, in the county of Surrey, gentleman, for certain improvements in looms for weaving. Patent dated February 28th, 1849; six months.

Obed Blake, of the Thames Plate Glass Company, Blackwall, in the county of Middlesex, manager, for certain improvements in the process or processes of manufacturing and finishing plates, sheets, or panes of glass. Patent dated February 28th, 1849; six months.

Joseph Barker, of Esher-street, Kennington, artist, for an improved method of constructing umbrellas and parasols. Patent dated February 28th, 1849; six months.

John Hick, of Bolton-le-moors, in the county of Lancaster, engineer, and William Hodgson Gratrix, of Salford, in the same county, engineer, for certain improvements in steam-engines, which improvements are more particularly applicable to marine engines, and also improvements in machinery or apparatus for propelling vessels. Patent dated February 28th, 1849; six months.

Benjamin Biram, of Wentworth, in the county of York, gentleman, for improvements in miners' lamps. Patent dated February 28th, 1849; six months.

Robert Pollard, of Topsham, in the county of Devon, ropemaker, for an improvement in rope-making machinery. Patent dated February 28th, 1849; six months.

Henry Crossley, of the firm of Henry Crossley, Son, and Galsworthy, of Emerson-street, Surrey, engineers and coppersmiths, for certain improved modes or methods of, and apparatus for, heating and lighting, for drying substances, and for employing air in a warm and cold state for manufacturing purposes. Patent dated February 28th, 1849; six months.

Perceval Moses Parsons, of Lewisham, in the county of Kent, civil engineer, for certain improvements in railways, railway engines and carriages, and certain of their appurtenances. Patent dated February 28th, 1849; six months.

Amedée François Remond, of Birmingham, for improvements in machinery for folding envelopes, and the manufacture of envelopes. Patent dated February 28th, 1849; six months.

William Brindley, of Twickenham, papier maché manufacturer, for improvements in the manufacture of waterproof paper. Patent dated February 28th, 1849; six months.

Charles Jacob, of Nine-elms, Surrey, engineer, for improvements in the manufacture of earthenware tubes or pipes. Patent dated February 28th, 1849; six months.

Dion de Bourcicault, of the Quadrant, Regent-street, gentleman, for certain improvements in the mode or modes to be used for transmitting and distributing liquids and fluids for agricultural purposes, and for apparatus connected therewith. Patent dated February 28th, 1849; six months.

Thomas Rowlandson, of Liverpool, chemist, for improvements in the treatment of certain mineral waters, to obtain products therefrom, and in obtaining certain metals from certain compounds containing those metals, and in obtaining other products, by the use of certain compounds containing metals. Patent dated February 28th, 1849; six months.

Charles André Félix Rochaz, of New-court, St. Swithin's-lane, in the city of London, merchant, for improvements in the manufacture of oxide of zinc, and in the making of paints and cements where oxide of zinc is used. Patent dated February 28th, 1849; six months.

Pierre Isidor David, of Paris, in the Republic of France, for improvements in bleaching cotton. Patent dated February 28th, 1849; six months.

Job Cutler, of Sparkbrook, near Birmingham, civil engineer, for certain improvements in the manufacture of metal pipes or tubes. Patent dated February 28th, 1849; six months.

George Fergusson Willson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters. Patent dated February 28th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND FROM THE 22D OF JANUARY, 1849, TO THE 22D OF FEBRUARY, 1849, INCLUSIVE.

William Martin, of St Pierre les Calais, in the Republic of France, mechanist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and to printing, and other like purposes. Sealed 24th January, 1849; six months.

Joseph Deeley, of Newport, in the county of Monmouth, engineer and ironfounder, for improvements in ovens and furnaces. Sealed 24th January, 1849; six months.

Alexander Parkes and Henry Parkes, of Birmingham, for improvements in the manufacture of metals, and alloys of metals, and in the treatment of metallic matters with various substances. Sealed 31st January, 1849; six months.

Laurence Hill, junior, of Motherwell Iron-works, near Hamilton, Lanarkshire, civil engineer, in consequence of a communication from Henry Burden, of Troy, in the United States of America, for improvements in the manufacture of iron, and in the machinery for producing the same. Sealed 31st January, 1849; six months.

Francis Hay Thomson, of Hope-street, in the city of Glasgow, North Britain, M.D., for an improvement in smelting copper and other ores. Sealed 2d February, 1849; four months.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, in consequence of a communication from Antoine Lohage, residing abroad, and partly by invention of his own, for improvements in the manufacture of soap. Sealed 5th February, 1849; six months.

David Napier and James Murdock Napier, of the York-road, Lambeth, in the county of Surrey, engineers, for improvements in mariners' compasses, also in barometers, and in certain other measuring instruments. Sealed 5th February, 1849; six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Sealed 5th February, 1849; six months.

Edmund George Pinchbeck, of Fleet-street, in the city of London, for improvements in certain parts of steam-engines. Sealed 5th February, 1849; six months.

James Robertson, of Great Howard-street, Liverpool, in the county of Lancaster, cooper, for improvements in the manufacture of casks and other wooden vessels, and in machinery for cutting wood for those purposes. Sealed 5th February, 1849; four months.

Fennell Allman, of 18, Charles-street, St. James's-square, Westminster, consulting engineer, for improvements in apparatus for the production of light from electricity. Sealed 7th February, 1849; four months.

Achille Chaudois, of Paris, in the Republic of France, manufacturing chemist, for improvements in extracting and preparing the colouring matter from orchil. Sealed 7th February, 1849; six months.

Thomas De la Rue, of Bunhill-row, in the county of Middlesex, manufacturer, for improvements in producing ornamental surfaces to paper and other substances. Sealed 9th February, 1849; six months.

Jonah Davies and George Davies, of the Albion Ironfoundry, in the parish of Tipton, Staffordshire, ironfounders, for improvements in steam-engines. Sealed 9th February, 1849; six months.

Samuel Brown, the younger, of Lambeth, in the county of Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids, and in substances in a running state, which apparatus are in part also applicable to other useful purposes. Sealed 12th February, 1849; six months.

Hugh Bell, of London, Esq., for certain improvements in aërial machines and machinery, in connection with the buoyant power produced by gaseous matter. Sealed 19th February, 1849; six months.

William Clay, of Clifton Lodge, in the county of Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinders or rollers are used. Sealed 19th February, 1849; six months.

Carey M'Clellan, of Larch Mount, in the liberties of the city of Londonderry, for an improved corn-mill. Sealed 20th February, 1849; four months.

Emanuel Miller, of Baltimore, Maryland, in the United States of America, gentleman, for certain improvements in dressing or cleaning grain, and in separating extraneous matters therefrom. Sealed 21st February, 1849; six months. (Communication.)

James Baird, of Gartsherrie, in the parish of Old Monkland, in the county of Lanark, in Scotland, iron master, and Alexander Whitelaw, of Gartsherrie Iron-works, parish and county aforesaid, manager of said works, for improvements in the method or process of manufacturing iron. Sealed 21st February, 1849; four months.

PATENTS RECENTLY EXPIRED.

J. Kay, of Pendleton, flax-spinner, for a heckling-machine of a new construction. Patent dated February 24th, 1835; expired February 24th, 1849.

J. H. Hallett, Esq., for an improvement in the construction or manufacture of cocks or taps for drawing off fluids. Patent dated February 25th, 1835; expired February 25th, 1849.

W. Aitkin, of Aberdeen, Esq., for certain improvements in the construction of carriages to be propelled by animal or other power. Patent dated February 25th, 1835; expired February 25th, 1849.

P. S. Hynes, Paddington, gentleman, for certain improvements in wheels, in axle-trees and boxes, and in apparatus for retarding or locking carriage wheels. Patent dated February 25th, 1835; expired February 25th, 1849.

J. Aldans, of Clapton, smith, for certain improvements in steam-engines. Patent dated February 25th, 1835; expired February 25th, 1849.

W. Newton, Middlesex, civil engineer, for certain improvements in preparing fibrous or textile plants, either indigenous or exotic, to be used in place of flax or hemp. Patent dated February 25th, 1835; expired February 25th, 1849. (Communication.)

R. Prosser, of Birmingham, civil engineer, for improvements in making nails. Patent dated February 25th, 1835; expired February 25th, 1849.

W. Davis, of Leeds, engineer, for an improvement in machinery for dressing of woollen or other cloths requiring such process. Patent dated February 25th, 1835; expired February 25th, 1849.

J. T. Beale, engineer, for a simplified and economical steam-engine, which engine may be used for other purposes. Patent dated February 27th, 1835; expired February 27th, 1849.

J. Levers, of Nottingham, machine-maker, and J. Pedder, for certain improvements in machinery for making bobbinet lace. Patent dated February 27th, 1835; expired February 27th, 1849.

F. L. H. Danehell, Middlesex, musical-instrument-maker, for certain improvements in pianofortes. Communicated partly by his partner, F. G. Greiner, a foreigner, residing abroad.

R. Wolf, Cornhill, musical-instrument-maker, for an improvement in pianofortes, consisting in the new construction, on the principle of acoustics, of a sounding body applicable to every description of pianofortes. Patent dated March 2d, 1835; expired March 2d, 1849.

PATENTS FOR INVENTIONS.—The following paragraph has been going the round of the newspapers:—"The number of patents sealed at Westminster during the year 1847 amounted to 498, and the amount of fees to £9,387; in Scotland, during the same period, to 168, fees £2,935; and in Ireland, to 76, fees £583." This statement, calculated to produce erroneous impressions on the mind of the public, needs little to be said to prove its entire inaccuracy. It would appear by this that the "fees" on an English patent amount to little more than £18, whilst the Scotch are only £11, and those of the Irish (well known to be higher than either) amount to the very insignificant sum of £7! As the usual charge made by respectable patent agents is, for an English patent, £110; for a Scotch, £78; and for an Irish patent, £138;

it would appear that these gentlemen must make a pretty good profit out of their business. So they would if this statement were correct; and it is not likely that they would, if this were the case, be found foremost in the ranks of those who advocate a reduction in the fees for patents. But this return shows how much—or, rather, how little—goes into the public purse out of the heavy fees paid for patents, and gives no account of the "lion's share" which is divided among a host of public cormorants. Why, there is one reverend gentleman who gets nearly as much as £18 out of every English patent, by virtue of his office (sinecure as to work) of clerk of the hanaper—or, more properly, hamper. The return is made of amounts paid into the consolidated fee fund, and (exclusive of stamps which benefit the revenue) is no guide to the cost of patents. We think it but justice to disabuse the public of erroneous impressions, and we cannot allow the officials to present to Parliament a return from which it would appear that the fees on patents are reasonably small, whilst the fact is that no mention is made of fees received to an enormous amount by these parties for services for which, in most instances, they are already overpaid.—*Patent Journal.*

TECHNICAL APPLICATION OF GALVANISM.

Gilding.—This process may be performed upon silver, brass, or copper, but not upon iron. The apparatus consists of a bladder containing dilute acid, in which zinc is immersed, and a jar within which the bladder is placed. The jar contains the solution of gold, together with the metal to be gilt, which is connected by a wire with the zinc.—(The gold solution and the metal to be gilt may also be placed within the bladder,—the dilute acid and a cylindrical zinc plate surrounding the bladder being placed in the outer vessel.)—The more dilute the acid, the feebler is the current, and the better does the gilding go on;—*e. g.*, six drops of acid to a glass of water. Sulphuric acid is used for silver, nitric acid with copper or brass.—The gold solution, which is made as neutral as possible, contains five milligrammes of gold in a cubic centimetre, and therefore one gramme of gold in a litre (about two pounds). A weaker solution gives a darker, and a solution containing copper mixed with the gold a redder, gilding.—The metal to be gilt may be either polished or merely cleaned. In the former case, the metal takes the gilding more readily, and the gilt surface has a much greater lustre, and merely requires rubbing with fine linen or with leather to give it a very high degree of polish; in the latter case the gilding is taken slowly, has a duller surface, and requires to be rubbed with the burnishing steel. Ignited silver takes a finer gilding than that which has not been ignited. The zinc is attached to a thick copper wire, and this to a silver or platinum wire, which touches at one point the metal to be gilt: this point must, however, be changed from time to time, otherwise no gold will be deposited upon it. Before the gilding process is commenced, the metal is dipped into dilute acid to free it from all impurities—silver in sulphuric, copper and brass in nitric, acid. If the zinc, contained in a bladder filled with the same acid, be at the same time immersed in the liquid, the gas-bubbles evolved on the surface of the silver or copper will serve to cleanse it still more effectually. After this the gilding is commenced. The bladder with the zinc being first placed in the gold solution, the circuit is closed by immersing the object previously metallically connected with the zinc. The metal to be gilt, especially if it be silver, must not be left for a moment in the gold solution without galvanic connection, otherwise it will either not be gilt at all or the gilding will be very bad. If, therefore, the inside of a vessel is to be gilt, the bladder with the acid and zinc being suspended within it, the gold solution must be poured into the vessel down the sides of the bladder, so that galvanic connection may be immediately formed. The galvanic current must be so weak that scarcely any gas shall be evolved on the surface of the silver or copper; for any considerable evolution of gas would interfere with the deposition of the gold. A feeble current is particularly necessary when sharp edges occur, for these are difficult to gild. The current is regulated by partially withdrawing the zinc or diminishing the quantity of acid. After remaining for a minute or two in the gold solution, the metal is again immersed in dilute acid; it is likewise advantageous to immerse the zinc and bladder at the same time (for this makes the gilding more brilliant, and ensures a more abundant deposition of gold at the next immersion). The metal is then briskly rubbed with fine linen and dried, then again subjected to galvanic action in the gold solution, and so on. Polished objects require two or three immersions — unpolished ones five or six. Brass requires less gold and takes a redder gilding than silver, the gilding on which is rather of a greenish yellow. The gilding is permanent. Those parts of an object which are not to be gilt are covered with wax, or washed with gold solution by means of a brush. The solution of gold when weakened by use is concentrated by evaporation. The bladder, which requires frequent renewal, yields a quantity of gold when burnt to ashes.—(De la Rive, "Ann. Chim. Phys.," 73, 398; also "J. pr. Chem.," 20, 157.) R. Böttger makes use of the following apparatus for gilding and platinizing:—A wide cylinder has a hole in the middle of its base, through which there passes a copper wire cemented in with sealing-wax. The part of the wire within the cylinder is formed into a flat spiral, upon which is laid a piece of amalgamated zinc. The cylinder contains very dilute sulphuric acid. In this is immersed a cylinder open at the top and bottom, but tied over at the bottom with a thin bladder. The cylinder contains solution of gold, in which the metal to be gilt is immersed after it has been first connected by means of a platinum wire wound round it, with the copper wire proceeding from the zinc. The gold solution contains one part of chloride of gold, freed as much as possible from excess of acid, in 160 parts of water; or, still better, chloride of gold and sodium dissolved in water. Each immersion lasts for a minute at the utmost, and is followed by washing with water and drying, accompanied by brisk rubbing with fine linen, and polishing with powdered chalk. Silver requires five or six, steel ten or twelve, immersions, lasting from half a minute to a minute. When the silver object is connected with the zinc by a copper wire, part of which dips into the solution of gold, the gilding acquires a strong reddish tint; whereas when silver or platinum wires are used it is of a full bright yellow. If the gold solution contains the smallest trace of copper, scarcely anything but copper is at first deposited upon the silver. Copper also does not show any appearance of gilding for some time, because the red colour of the metal shines through. (The same was observed by Biewend, "J. pr. Chem.," 23, 253.) Brass may be gilt almost as well as silver, tin not so well. German silver gives a coppery kind of gilding, not very beautiful. But watch-springs, penknives, &c., may be gilt directly by De la Rive's method. Watch-springs take a very beautiful gilding, when they are freed by hydrochloric acid from the blue film of oxide. On long knives the gilding is not uniform, being thickest at the end next to the zinc. Steel which is to be gilt must be brightly polished without oil; that which has been polished with oil does not take the gold, for it retains particles of oil closely attached to its surface, so that it is scarcely attacked by strong hydrochloric acid. (R. Böttger, "Ann. Pharm.," 35, 221, and 350.) The bladder recommended by De la Rive reduces a considerable quantity of gold, which gives it a purple colour; a cylinder tied over with bladder at the bottom is therefore to be preferred. Only a feeble current is required, and a single drop of sulphuric acid is enough for every ounce of water. If the gold solution reddens litmus, it produces a dirty yellow coating on the silver, hence it must first be exactly neutralized with carbonate of soda. It must likewise be more dilute than Böttger recommends; water must, in fact, be added to it till a plate of silver dipped into it no longer acquires a black coating, but exhibits a bright yellow colour on being rubbed. When the process is thus conducted, the silver no longer acquires a greenish-yellow, but a pure bright yellow gilding; or, if it be connected with the zinc by a copper wire, it then takes, as Böttger found, a reddish-yellow gilding. Steel pens, freed by dilute hydrochloric acid from their blue film of oxide, may be gilt without the aid of galvanism, by simply immersing them in the gold solution neutralized as above, with carbonate of soda. Copper may likewise be gilt in a very short time, either by ordinary chemical action, like steel, or by the galvanic method.—(Elsner, "J. pr. Chem.," 23, 148) Walker ("Phil. Mag. J.," 19, 328) makes use of the current of a voltaic battery. The decomposing cell contains a solution of cyanide of gold and potassium; the anode consists of a plate of gold, and the cathode of the metal to be gilt. As fast as gold is precipitated from the solution on the cathode, fresh gold is dissolved at the anode. A similar method is pursued by Elkington ("Compt. Rend.," 13, 998; also "Pogg.," 55, 161), according to whom gilding goes on more quickly at a somewhat elevated temperature than in the cold. According to Ruolz ("Pogg.," 55, 161) the following solutions are available for this purpose:—Cyanide or chloride of gold in aqueous solution of cyanide of potassium, ordinary ferrocyanide of potassium or red ferrocyanide of potassium; chloride of gold and potassium in aqueous solution of cyanide of potassium, or in aqueous solution of soda; sulphuret of gold in aqueous solution of sulphuret of potasssium. The last three solutions are to be preferred—the last, which contains sulphur, being the best of all. In this manner platinum, silver, copper, and steel may be gilt permanently, beautifully, and of any required thickness. A solution of one part of chloride of gold and ten parts of ferrocyanide of potassium in 100 parts of water, being subjected to the action of a six-pair Daniell's battery, deposits in three minutes, on a polished silver plate, five square centimetres in surface, the following quantities of gold, varying according to the temperature:—At 15°, 0.0126; at 35°, 0.0296; and at 60°, 0.063 of a gramme. The quantity of gold deposited on a brass plate of equal size at 15° in two minutes was 0.012 of a gramme.—(Dumas.) De la Rive's method produces a brilliant gilding, that of Ruolz gives a fine frosted surface which may be made bright by polishing. De la Rive's solution acts partly by ordinary chemical action, because it contains too much gold, and is not sufficiently neutralized. The following method gives the best results.—Gold solution: One part of dry chloride of gold and ten parts of ordinary ferrocyanide of potassium are dissolved in 100 parts of water, filtered from cyanide of iron, mixed with 100 parts of saturated solution of ferrocyanide of potassium, and this mixture is diluted with an equal or double quantity of water: the more dilute the solution the brighter is the frosted gilding produced.—Liquid in the zinc vessel: solution of ordinary ferrocyanide of potassium and common salt:—solution of common salt alone acts more quickly; but for gilding silver the solution must not contain too much common salt, otherwise the silver will be blackened by the formation of chloride. All acid is to be avoided; it gives too strong a current. It is advantageous to have the gold solution and the liquid in the zinc vessel of the same specific gravity, in order that they may not mix too easily. For the same reason, the level of the two liquids ought to be the same. The zinc must not be amalgamated, otherwise chloride of mercury will be introduced into the gold solution, and may be reduced on the metal.—Vessels: For gilding small objects, the gold solu-

tion may be contained in a glass tube, open at both ends; for larger objects, in an inverted bell-jar, furnished with a tubulure. The lower end of the glass tube or the tubulure of the bell-jar is tied over with linen, and a layer of kaolin or common clay, free from lime, one centimetre in height, and moistened with solution of common salt, placed at the bottom of the tube or jar. If, instead of glass, vessels of earthenware are used, in which endosmose is stronger than in clay, then either the inner and outer liquids must have the same composition (with the exception of the gold contained in the inner), or the earthen vessel must be enclosed within a bag of muslin filled with moist clay, so that the vessel may be surrounded with a coating of clay one or two centimetres in thickness. The brass, copper, or silver which is to be gilt is well burnished, and then thoroughly cleansed (*decapé*) by rubbing it with lampblack moistened with concentrated nitric acid and spread upon linen—then dipping it quickly into water, then again rubbing it—and so on: when perfectly clean and bright, it is well dried. While the gilding is going on, the object is frequently turned, so that the deposit of gold may be uniform. If the deposition goes on too slowly, an additional quantity of common salt is added to the liquid in the outer vessel containing the zinc. Warming the outer vessel in a water-bath to 20° or 25° (68° or 77° Fahr.) likewise accelerates the gilding, but diminishes its lustre. If any of the gold solution penetrates into the outer vessel, and gold is in consequence precipitated upon the zinc, it must be removed. A thin deposit of gold makes its appearance in ten minutes; to produce a thick deposit several hours are necessary. The gilding on silver is first greenish, then yellow, then, after twelve hours, reddish-yellow. Brass and bronze take the gilding much more quickly. Finally, the gilt object is washed with dilute sulphuric acid, which removes any iron which may perchance have been precipitated, and then rubbed with linen. The gilding holds very fast.—(Becquerel, "Compt. Rend.," 14, 135.) When a copper plate is to be etched, instead of covering it with the ordinary etching ground, it may be gilt by De la Rive's method, and then the gold removed with the needle; in this manner much finer lines are obtained. Moreover, since the gold remains attached to the surface, the plate may be corrected, if the first impression should be faulty.

Platinizing.—This may be done upon silver, brass, or copper. The apparatus is the same as that of Böttger for gilding. The platinum solution used consists of one part of chloride of platinum in 160 parts of water—or better, one part of chloride of platinum, and one part of common salt in 160 of water. The latter solution yields a sufficient deposit after three immersions; whereas with the former six immersions are necessary, and the coating of platinum is rather grey than white. Copper which has been platinized is afterwards well adapted for gilding. This may be done with objects obtained by the electrotype process—a copper wire being fastened to the centre of the hinder surface, that surface covered with wax, the front surface freed from every trace of oxide by rubbing with dilute hydrochloric acid and fine washed sand, then, by the preceding method, first platinized and afterwards gilt. Any part on which the oxide still remains will not be coated, and must afterwards be cleaned with sand and acid. (R. Böttger.) For platinizing by the current of a six-pair Daniell's battery, it is best to use a solution of chloride of platinum and potassium in potash. The operation goes on as quickly as gilding. But from a solution of one part of cyanide of platinum and ten parts of yellow ferrocyanide of potassium in 100 parts of water, platinum is very slowly precipitated, even when assisted by the application of heat.—(Ruolz and Dumas, "Pogg," 55, 164.)

Coppering.—A solution of cyanide of copper in cyanide of potassium or sodium yields a coating of copper when acted upon by the current of an eight-pair Daniell's battery; but the deposition of the copper is very slow. (Ruolz.)—In a similar manner metals may be coated with lead, cobalt, or nickel.—(Ruolz.)

Tinning.—Clean copper or brass, in contact with cuttings of tin in a boiling solution of peroxide of tin in potash, becomes covered in a few minutes with a white permanent layer of tin. (R. Böttger.)—Bronze may likewise be tinned in this manner. With electro-positive metals, on the contrary, such as iron or zinc, the current of a battery is necessary. (Ruolz.)

Zincing.—Copper or brass cleaned with dilute hydrochloric acid, and placed in close contact with granulated zinc, in a boiling saturated solution of sal-ammoniac, or a solution of chloride of zinc, acquires in a few minutes a specular covering of zinc. Cream of tartar, in place of sal-ammoniac, does not occasion a deposit of zinc. (R. Böttger, *Ann. Pharm.*, 34, 84, 39, 172).—By means of the electric current of a battery, iron wire, iron plate, cast iron, &c., may also be coated with zinc, and preserved from rust. (Ruolz.)—*Gmelin's Handbook of Chemistry.*

Railway Communication with the Continent.—The railway system in France having extended itself to the northern coast, a line of railway communication has been opened from Calais right through the very heart of Europe, embracing in its course the great capitals of the north, and, at the same time, opening up the means of communication with the various continental nations of the south. We are happy to be able to announce that the great wheel of progress is on the move, and have every reason to hope that arrangements, ere long, will be completed by which the man of commerce, or the pleasure tourist, may be enabled to take his ticket at the offices of the South-Eastern Railway Company, at London-bridge, which shall free him from that starting-point to Paris, to Brussels, Antwerp, the Rhine, and even to Berlin, and without any hindrance, except those which may be termed station stoppages. We have placed Berlin at the end of the journey, but it certainly is not the *ultima Thule* of the great benefit which is to be secured. The traveller may go on to Warsaw by railway, if he be bound to St. Petersburg and the extreme north of Europe. Turning to the south, the communications will be established to the very walls of Vienna, and so on again to Switzerland, and ultimately to Venice. Now, an arrangement which, in its effect, shall make this one grand means of uninterrupted communication, commencing at London-bridge, in London, and running out through Europe, in branches terminating at Brussels, Cologne, Berlin, Leipsic, Vienna, and Venice, must have a salutary effect upon the whole civilized world. A similar arrangement in little is in operation in this country, inasmuch as the traveller can book himself in Euston-square for Edinburgh, and never leave his carriage until he arrives in that city. We believe that we may say that the preliminaries to such an arrangement as regards the continental traffic have been settled, and there is every prospect of its being carried to a successful issue. The result establishes a grand route for continental tourists, a perfect concentrated sketch of rail, and a concurrent harmony of working. Paris may thus be reached from London in eleven hours, that is in three hours less than either Edinburgh or Dublin. The time occupied *en route* to the respective places will be nearly as follows, by express:—From London to Folkestone, 85 miles, 2½ hours; from Folkestone to Boulogne, 26 miles, 2 hours; from Boulogne to Paris, 170 miles, 6¼ hours; or a total from London to Paris, 281 miles, in 11 hours; from Paris to Brussels, 231 miles, in 11 hours; from Paris to the Rhine, 529 miles, in 43 hours; from Paris to Leipsic, 757 miles, in 67 hours; from Paris to Warsaw, 1,263 miles, in 114 hours. This vast commercial arrangement will work greater revolutions than forests of glittering steel, "and will," as we lately heard the Belgian Minister eloquently express it, "carry upon the wings of fire peace and good will to all nations."—*Railway Record.*

TO CORRESPONDENTS.

"W. J."—"Mineralogy," by J. D. Dana, J. Lindley's "Introduction to Botany," and several other botanical works by the same author ("Elements of Botany," "Principles of Botany," "Vegetable Kingdom"), or the "Elements of Botany," by Adrien de Jussieu, translated by J. H. Wilson, published by John Van Voorst.

"Honestas" is informed that "Our Own Series" has been discontinued simply during the temporary absence of the editor, and will shortly be resumed. With respect to the other points touched upon in "H.'s" communication, we must remind our correspondent that he is not our *only* subscriber, and that it would be exceedingly difficult to please every one of our numerous subscribers equally. "Honesta's" advice would have come with a better grace had he thought fit to append his own *bonâ fide* name to it. A little more courtesy also would have done no harm.

"Inquirer."—We really cannot inform you whether the recipe which you have enclosed to us will answer the purpose for which you intend to apply it or not. A veterinary surgeon of experience would be the most likely party to tell you. From the nature of the ingredients we should feel inclined to think the recipe a good one; a trial of it, at all events, can do no harm. Prepare the decoction as you need it.

"A Subscriber, Aberdeen."—We do not know the patented process to which you allude, nor the name or address of the patentee. The usual way of preparing paraffine is as follows:—Distil beech-tar to dryness; rectify the heavy oil which collects at the bottom of the receiver; as soon as a thick matter begins to rise set aside the distillate; keep the still exposed to a moderate heat as long as anything continues to pass over. The product in the receiver is pyrélaine, containing crystalline scales of paraffine. Digest this mixture of pyrélaine and paraffine with an equal volume of alcohol of 0.833. You will obtain a limpid solution, which dilute gradually with alcohol, to the extent of six to eight times its volume. The alcohol, which at first dissolved the whole product, will now gradually deposit the paraffine. Strain the liquid off from deposit, and wash the latter with cold alcohol until it appears nearly colourless. Dissolve it now in boiling alcohol; this solution will, upon cooling, deposit the pure paraffine in minute spangles and needles.

"O. P. B."—It would in a great measure depend upon the specification and the claims. Of course, when a patentee confines himself in his claims strictly to the manufacture of a certain article by means of certain apparatus and appliances, we should say, the use of these latter for totally different purposes could not be objected to by him on the strength of his patent. We would advise our correspondent, however, to apply to the editor of the *Patent Journal*, who, we doubt not, will give him more positive information on the point. With respect to the other point touched upon in our correspondent's letter, we will endeavour to comply shortly with his request.

"Mr. J. M. Greene, Manchester.—The most energetic arrangement is that proposed by Mr. Grove. It consists essentially of a slip of platinum foil, furnished with a conducting wire. The foil is immersed in a cylinder of porous earthenware filled with strong nitric acid (sp. gr. 1.33). This cylinder is surrounded by a roll of amalgamated zinc, having a conducting wire soldered to it; the zinc roll is placed in an earthen or glass jar containing dilute sulphuric acid.

"Chemicus, Leamington."—The extract which you mention is used by the more respectable brewers to colour their beer. Some parties use burnt sugar (caramel) for this purpose, but the most respectable houses concentrate a quantity of their first and best wort in an iron pan to the consistence of an extract, and burn it subsequently into a colouring stuff, whereby they are enabled to lay claim to the merit of using nothing in their manufacture except malt and hops.

"R. J. E."—Apply to Mr. Simpson, of 1, Kennington-road, who keeps constantly a large assortment of chemical apparatus. We do not know whether Griffin's "Treatise on Glass-blowing" is out of print. Get a local bookseller to make the inquiry of the publisher.

"A. Z."—We have repeatedly given the process for preparing vulcanized indiarubber. We must, therefore, refer our correspondent to our back numbers.

"Mr. J. Wilson, Birmingham."—Your request has been complied with.

"R. R. R."—The work in question may be had at the publishers', Longman, Orme, and Co., Paternoster-row. The price is £1 1s.

"T. B."—The concentrated acid should be used.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—March 10, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture IX.

In my last lecture we finished with the account of the action of potassa upon indigo, disproving the assertion of Gerhardt that valerianic acid was one of the products. We will now enter upon salicine, discovered by Fontana, and first obtained in a pure state by Leroux. It is found in the leaves and bark of all bitter willows, in salix helix, also in salix amygdalina, and in some varieties of the poplar. According to M. Merck, it is best prepared by taking willow bark in a crushed state, and exhausting it with repeated affusions of boiling water, evaporating the decoctions, digesting for some hours with precipitated oxide of lead, removing the dissolved lead, first by sulphuric acid, then by sulphide of barium, and, after the separation of the sulphide of lead, concentrating, when salicine crystallizes. It can be purified by repeated solution and crystallization. When this process is carefully performed neither sulphuric acid nor baryta remains in solution. Moreover, the formed sulphide of lead reduces the colour of the menstruum. Salicine crystallizes from its aqueous solution in colourless, inodorous, satiny-looking laminæ, persistent in air, from its weak acid solutions, in four-sided prisms. It possesses a most styptic taste, is easily soluble in alcohol and boiling water, but is not dissolved by ether or the fixed oils. Salicine is not precipitated by any reagent. Strong sulphuric acid dissolves it with a blood-red colour. By the action of diluted acids and heat it is resolved into saliretine and sugar. When salicine is slightly warmed with synaptase* it splits into saligenine and sugar; as the heat augments the saligenine becomes saliretine. Salicine may be represented as a compound of sugar and saligenine:—

1 eq. sugar	$C_{12} H_{10} O_{10}$
1 eq. saligenine	$C_{14} H_8 O_4$
1 eq. salicine	$C_{26} H_{18} O_{14}$

Saligenine imparts to solutions of the sesquisalts of iron a deep indigo-blue colour. It crystallizes in magnificent pearly crystals, soluble in water, alcohol, and ether. Saligenine remains unchanged in the air, but when mixed with spongy platinum oxidizes, affording hydride of salicyle and water.

Nitric acid at the ordinary temperature, when allowed to act upon salicine, changes the saligenine into salicylous acid, which remains in combination with the sugar. This compound is called helicine by Piria. Salicine with strong nitric acid gives oxalic and carbazotic acids. Helicine in the heat gives hydride of salicyle; with alkalis, metallic salicylides; and with strong acids, sugar and hydride of salicyle. When extremely weak nitric acid is employed, salicine affords another substance, helicoidine. This is a still lower state of oxidation, being found to consist of:—

2 eq. sugar	$C_{24} H_{20} O_{10}$
1 eq. hydride of salicyle ..	$C_{14} H_6 O_4$
1 eq. saligenine	$C_{14} H_8 O_4$
Anhydrous helicoidine. .	$C_{52} H_{34} O_{18}$

This is a most remarkable substance in its constitution. You will see that helicoidine can be also represented as a compound of helicine and salicine:—

Salicine	$C_{26} H_{18} O_4$
Helicine..	$C_{26} H_{16} O_{14}$
Helicoidine	$C_{52} H_{34} O_{18}$

* The white portion of sweet and bitter almonds consists mostly of a body remarkable on account of a peculiar decomposition it suffers in contact with amygdaline and water. Liebig and Wöhler called the substance emulsine. Robiquet, who has isolated it, names it synaptase.

but it does not contain salicine; only its elements. Helicoidine may be distinguished from helicine, being converted by synaptase into sugar, saligenine, and hydride of salicyle; and by weak acids into sugar, saliretine, and hydride of salicyle.

Helicine gives with synaptase sugar and hydride of salicyle; with dilute acids, in the heat, hydride of salicyle, which passes off with the aqueous vapour and sugar remaining in the liquid. I mentioned that oil of vitriol dissolves salicine with a blood-red colour, rutiline is formed, but it is only known in combination with the acid. The best way to obtain the rutilsulphuric acid is to mix the blood-red liquor with anhydrous ether. Two layers appear, the upper consisting of sulphuric acid and ether, and the under of rutilsulphuric acid and ether. The lower stratum must be agitated several times with ether to get rid of the uncombined sulphuric acid, and then the desired compound precipitated by anhydrous alcohol. The formula for the rutilsulphuric acid is:—

$$C_{28} H_{12} O_4, SO_3.$$

It is a violet powder, which does not combine with bases, and is insoluble in water, alcohol, and ether.

Rutiline is also formed by acting upon populine* with sulphuric acid. I have mentioned to you several times the hydride of salicyle, first discovered by Pagenstecher in the volatile oil of spiræa ulmaria. It is produced, you have heard, as a product of the oxidation of salicine. Löwig gives the following processes for its preparation. The oil of spiræa is distilled with an excess of aqua potassa till neutral oil ceases to pass over. The residue, a solution of a compound of the hydride with potassa, is supersaturated with weak sulphuric acid, and redistilled, when the acid hydride distils with aqueous vapour. Or, according to Ettling, a mixture consisting of three parts of salicine, three of bichromate of potassa, four and a half of strong sulphuric acid, and thirty-six of water, is subjected to the retort. The salicine is dissolved in a portion of the water, the acid diluted with the rest, the whole materials are then mixed; heat is developed, and a gentle effervescence ensues. When this has ceased the distillation is commenced. Half a pound of salicine yields about two ounces of hydride of salicyle. In the two processes the distillate contains the hydride, which separates from the water. It may be purified by ablutions with water, and rectification over chloride of calcium. Hydride of salicyle, when perfectly pure, is a colourless oil, possessing the aromatic odour of the flower of the spiræa. It has an astringent taste, leaving on the tongue a white blister. The vapour bleaches litmus. It is slightly dissolved in water, but with alcohol and ether it is in all proportions miscible. The sp. gr. of the oil is 1.1731. It boils at 196°.

Formula.

$$C_{14} H_6 O_4, \text{ or } C_{14} H_5 O_4 + H.$$

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE XLIX.

(LECTURE LXXVII.)

EXTRACTIVE.

SECTION V.—BITTER EXTRACTIVE ASSOCIATED WITH ESSENTIAL OIL.—(*Continued.*)

WHITE MUSTARD SEED.

(Sinapis alba.)

The seeds of Sinapis alba have the greatest possible analogy with those of Sinapis nigra, from which they differ principally in this, that they contain sulphosinapisin, a substance which is not found in Sinapis nigra. Sulphosinapisin was first discovered by MM. Henry and Garot; it is bitter, inodorous, soluble in water, alcohol, and ether. Sulphur is one of its constituent elements.

White mustard does not yield volatile oil, but an acrid, fixed principle is generated in it under certain circumstances.

M. Simon has observed that the action of hot water deprives white mustard completely of its acridity. The water need not be boiling to produce this effect.

The action of ether or alcohol upon the dry seeds fails to eliminate any acrid principle; but if the seeds have been moistened previously with water they yield an exceedingly acrid solution with ether.

The acrid principle is generated by the action of water upon the seeds. It appears, however, that the presence of the sulphosinapisin is equally necessary to the development of the acrid principle, since seeds that have been deprived of the sulphosinapisin by the action of alcohol yield no acrid principle on being subsequently treated with water.

The acrid principle of the white mustard seed was first discovered by MM. Robiquet and Boutron. It is an unctuous, inodorous, reddish liquid; it has a biting taste, analogous to that of horseradish. According to M. Fauré, of Bordeaux, the same principle is generated, though to a very trifling extent only, in the acrid products of the action of water upon Sinapis nigra.

To prepare the acrid principle, treat the cake of the white mustard seeds with ether, by the method of displacement; separate the sweet oil which comes off first. Distil the ethereal liquids, and treat the residue with cold alcohol, which dissolves the acrid principle in conjunction with a portion of the oil. Distil the alcoholic solution, and treat the residue again with cold alcohol; the menstruum dissolves again the acrid principle, but this time with a less considerable admixture of oil than in the first process. By repeating the same manipulation five or six times, and oftener, the acrid principle may be gradually freed from the greater portion of the oil.

White mustard, when left in contact with cold water, yields an almost insipid, thick, mucilaginous liquid. Black mustard, when placed in the same conditions, yields a trifling proportion of mucilage, and imparts to the water a pungent taste.—(Cadet.)

The seeds of white mustard left entire impart to white wine a disagreeable, though only feeble, odour and taste, and render the wine viscous. The bruised seeds, on the contrary, impart to the liquor a very pungent taste.

White mustard is administered entire in medicine. One or several tablespoonfuls of the seeds are given *per diem* in certain affections of the digestive canal.

GARLIC.

Garlic (Allium sativum) contains:—

An acrid volatile oil,
Starch,
Albumen,
Saccharine matter.

The volatile oil of garlic is exceedingly acrid. It produces a smart pain when applied on the skin; its colour is yellow, its odour highly penetrating. It is denser than water; it is very soluble in alcohol.

It has been carefully studied by Wertheim. It consists of a mixture of three different essences. The one of these three essences, and which constitutes nearly the whole of the mixture, is a hydrosulphuretted oil,

$$C_3 H_5 S.$$

Of the remaining two, the one contains a larger

* Populine accompanies salicine in the leaves and bark of populus tremula. To obtain it the bark must be boiled with water, the decoction mixed with acetate of lead, the excess of lead separated by hydrosulphuric acid, the filtrate concentrated, then boiled with animal charcoal, and filtered while hot. The salicine crystallizes. When all the salicine has deposited it must be separated, and the menstruum mixed with carbonate of potassa, which throws down the populine. Desiccated between folds of bibulous paper, and dissolved in hot water, it is obtained pure.

amount of sulphur than the preceding, to which it is completely assimilated by the action of potassium, which removes the excess of sulphur. The third is an oxygenated essence; the sulphur is replaced in it by an equivalent of oxygen. Its composition is:—

$C_3 H_5 O$.

The first of these three essences may be obtained pure by distilling the volatile oil of garlic repeatedly over potassium. The pure hydrosulphuretted essence is liquid, very limpid, highly refrangible, and lighter than water. It colours nitrate of silver black; sulphuret of silver is formed, and the sulphuretted oil is converted into the oxygenated oil.

The oil of garlic is closely allied to the essences of the Cruciferæ. Thus, the root of Erysimum alliaria contains an oil analogous to the essence of mustard, whilst the leaves of the same plant contain an oil similar to the essence of garlic, and sometimes only the common essence of the cruciferæ.

100 kilogrammes of garlic yield 200 to 300 grammes of volatile oil.

Garlic administered internally acts as a stimulant; applied externally it produces redness, and may even draw blisters.

GARLIC PULP.

Pound the garlic bulbs in a mortar.

This pulp is sometimes added to mustard poultices; it might also be used alone, but, as garlic has a tendency to produce ulcerations, which it is often found difficult to cure, the better course is to use mustard poultices instead, either with or without admixture of garlic.

GARLIC VINEGAR.

Take of Garlic, 1 part.
Strong vinegar, 12 parts.

Let the garlic macerate in the vinegar for eight days.

OXYMEL OF GARLIC.

Take of Garlic vinegar, 100 parts.
White honey, 200 parts.

Evaporate the vinegar in the water-bath until it is reduced to twenty-nine parts; add the honey, and form a mellite by simple solution. Clarify by filtration through paper.

SYRUP OF GARLIC.

Take of Garlic, 1 part.
Boiling water, 8 parts.
White sugar, about 16 parts.

Let the oil infuse in the water; strain, and add to 100 parts of the liquid 190 parts of sugar. Make a syrup by solution in the water-bath.

This syrup is given as a vermifuge.

ONION.

The onion (Allium cepa) contains, according to Fourcroy and Vauquelin:—

Volatile oil,
Uncrystallizable sugar,
Gum,
Animal matter,
Phosphoric acid,
Acetic acid,
Phosphate of lime,
Citrate of lime.

The volatile oil of the onion is acrid and pungent; it contains sulphur, like that of garlic, but is colourless.

The juice of the onion is colourless. Upon exposure to the air it acquires a rose tint. Left to itself, it does not suffer alcoholic fermentation, but acetic acid and mannite are generated in it. Onion possesses stimulating and diuretic properties. The process of coction dissipates the volatile oil of the onion, and the product (the syrup or the boiled pulp, for instance) has no longer stimulating properties.

DIURETIC POTION.

Take One onion.
A pinch of incised cresses.
600 grammes of clarified whey.

Cut the onion in slices, and pour the boiling whey over the slices and the incised cresses. Let it infuse, and strain.

DIURETIC WINE.

Take of Onions, No. 2.
White wine, 100 grammes.

Let the onions macerate in the wine, and strain.

This is a popular remedy, which enjoys a considerable and well-deserved reputation as a diuretic.

SYRUP OF ONIONS.

Take of White onions, 2 parts.
White sugar, 5 parts.

Boil the onions in four times their weight of water; strain the liquid, and prepare a syrup by coction and clarification.

Or mix the decoction of the onions with sugar syrup, and boil the mixture down to the proper degree of consistence.

The syrup of onions is viscous. It is given as a demulcent in colds; part of its action may be attributable, perhaps, to the presence of some fixed principle analogous to scillitin.

SECTION VI.—EXTRACTIVE ASSOCIATED WITH RESIN AND ESSENTIAL OIL.

The substances in which the extractive is associated with resin and essential oil constitute, almost without exception, medicinal agents. To this class belong more particularly the following:—

The corymbiferæ,
The roots of the ombelliferæ,
Savin,
Rue,
Juniper berries,
Virginian snakeroot,
Valerian,
Iris florentina.

CORYMBIFERÆ.

We find in the corymbiferæ a bitter matter and volatile oil. The presence of these two principles imparts to the corymbiferæ tonic and stimulating properties. According as the bitter or the volatile principle predominates, the plants are more tonic than stimulating or vice versâ.

It is on account of these general properties that the corymbiferæ are employed in medicine as emmenagogues, anti-hysterics, vulneraries, stomachics, and febrifuges.

The elicampane and the Solidago virga aurea are used chiefly as bitter tonics; they contain only a comparatively small proportion of volatile oil.

We use as emmenagogues, stomachics, and stimulants, the various species of Artemisia and of the Achilleæ, the Matriearia parthenium, Matricaria chamœmilla, Anthemis nobilis; it is perhaps to the same stimulating property that the Mikania guako and the Mikania opifera, of Brazil, owe their efficacy against snake-bites.

As vermifuges we use principally the Santolina chamœcyparissus, Tanacetum vulgare, Artemisia absinthium, the flowers of Artemisia contra and Artemisia judaïca which yield the Semen-contra of Aleppo, those of A. glomerulata and ramosa which yield the Semen-contra of Barbary, and those of A. eampestris and absinthium which yield our indigenous semen-contra, and also the seeds of Ascaricida anthelmintica, which are known in India by the name of *Calageri*. The mixture of three plants of this family constitute the anthelmintic species.

ANTHELMINTIC SPECIES.

Take of Tops of wormwood,
" tansy,
Flowers of the Roman camomile (Anthemis nobilis), of each equal parts.

Mix.

Several species of the corymbiferæ are used as vulneraries; to this class belong more particularly Achillæa millefolium, the white Genepis (Artemisia glacialis, rupestris, mutellina, vallesiaca, and spicata), the black Genepis (Achillæa herba rosa, moschata, atrata).

Some of the corymbiferæ which have less energetic properties are used as pectorals; such are, for instance, the Tussilago farfara, Gnaphalium dioicum, Eupatorium ayapana, Hubertia ambavilla (of the Mauritius). Some species (marigold, groundsel, &c.) are nearly altogether inert.

Some of the corymbiferæ have properties totally different from those of the generality. Thus, for instance, the Bailleria aspera, of Cayenne has the faculty of intoxicating fishes; the root of Eupatorium cannabinum is purgative, and contains, according to M. Righimi, an alkaline base of a pungent taste, and to which that gentleman has given the name *Eupatorin;* the root of Arnica has been used as an emetic; the flowers of Arnica have an energetic action, and produce giddiness and trembling.

Certain of the corymbiferæ have a pungent taste, which provokes salivation: these are, accordingly, used as sialalogues. Such are, for instance, the Spilanthus oleracea, Acmella repens and mauritiana, Bidens tripartita and cernua, Osmites camphorina (of the Cape). This latter plant yields upon distillation a water which is sometimes given against paralysis, and bears the name of "Eau de Pâquerettes." The same sialalogic property we find also in the roots of the Anthemis pyrethrum, Achillæa ptarmica, Spilanthus urens, of Carthagena, Sigisbeckia orientalis, of India. According to the analysis of M. Gauthier, the acrid principle of the Anthemis pyrethrum is a species of resinoïd oil, insoluble in water; a perfectly analogous matter has been found in the Spilanthus oleracea.

All the essential oils of the corymbiferæ have the general characteristic of volatile oils; those of them which have been studied are oxygenated, and appear to consist of a mixture of several essences. The chemical properties of the bitter principle of the corymbiferæ are not well known. In the flower-tops of several species of the genus Artemisia we find santolin, a crystalline matter of which the solution is exceedingly bitter. What analogy there exists between this and the other bitter principles of the family we do not know. However, M. Leroz, of Brussels, has extracted from tansy an analogous matter which is white, crystalline, exceedingly bitter, hardly soluble in water, but very readily soluble in alcohol, and still more so in ether.

ELICAMPANE.

The root of the elicampane (Inula helenium) is the only part of this plant which is used in medicine. It is given as a tonic and a stimulant. It is recommended particularly in chronic catarrhs with pulmonary obstruction. It is also frequently employed in cases of general debility occurring in young girls labouring under amenorrhœa; it is likewise used in cases of visceral obstruction.

The root of the elicampane has been analyzed by Feneulle and John. It contains:—

Volatile oil,
Helenin,
A soft and acrid resin,
Wax,
Bitter extractive,
Gum,
Inulin,
Vegetable albumen,
Some salts.

The helenin, which is called also camphor of elicampane, is a stearoptene. Upon the distillation of the elicampane-root a yellowish oil passes over, which sinks to the bottom of the water and concretes; this is the helenin. It may be obtained in the crystalline state by the refrigeration of a hot saturated alcoholic tincture of elicampane.

Helenin is a volatile substance; it has the smell of the elicampane. It fuses at 161.6 Fahr.; it is sparingly soluble in water and cold, but very readily soluble in hot, alcohol. It dissolves readily in the volatile oils and in ether. M. Gerhardt gives its composition as

$C_{21} H_{11} O_8$.

According to M. Rich, of Mulhouse, the proportion of helenin in the dry root increases with age.

The resin of elicampane is soft and brown; it has a bitter, acrid, and disagreeable taste. It has an aromatic odour which it exhales when heated. It is not soluble in water, but dissolves

readily in alcohol and in ether. The heat of boiling water suffices to effect its fusion.

Inulin is a species of stareh, which was first discovered by Rose in the elicampane-root, but has since been found in several other substanees, and more partieularly in the roots of plants of the family of the corymbiferæ. It has the same chemical composition as stareh. It is white, pulverulent, and has neither smell nor taste. When heated to somewhat above 212° Fahr., it loses water and enters into fusion. It strikes a yellow tint with iodine. It is very sparingly soluble in cold, but very readily soluble in boiling, water. Its aqueous solution is mueilaginous; upon the evaporation of this solution the inulin separates in the form of membranous pellieles. Upon refrigeration of the boiling solution, the inulin is deposited in the pulverulent state. After protracted ebullition the inulin is found to have lost the property of separating from the solution upon eooling.

Inulin is not soluble in aleohol. Dilute aeids eonvert it more readily into sugar than they do stareh. Supposing stareh and inulin to be present together in the same solution, the inulin will be deposited alone if the starch be present in exeess, whereas, if the inulin predominate, the preeipitate of the latter will carry down with it a portion of the starch.

POWDER OF ELICAMPANE.

Reduce the root to powder without leaving any residue.

The powder of elieampane is given in doses of from 50 to 60 eentigrammes to 4 and even 8 grammes.

PRESERVE OF ELICAMPANE.

Take of Powder of elicampane, 1 part.
Water, 2 parts.
Pounded sugar, 8 parts.

Mix the powder with the water, and let the mixture stand at rest for several hours ; add subsequently the sugar, and heat a few minutes in the water-bath.

This preserve was formerly prepared with the pulp of the root, obtained by coetion. Thus prepared, it was exceedingly liable to speedy alteration.

DISTILLED WATER OF ELICAMPANE.

Take of Powdered dry elieampane-root, any quantity you like.
Water, a sufficieney.

Moisten the root with water, leave it for twelve hours in that state, and then distil off four parts of produet in the steam apparatus. The distillate is turbid, owing to particles of helenin whieh it holds in mechanieal suspension ; after some time these particles are deposited.

POTION OF ELICAMPANE.

Take of Pounded elicampane - root, 20 grammes.
Boiling water, 1,000 grammes.

Let the root infuse in the water for one hour ; strain.

EXTRACT OF ELICAMPANE.

Reduce the root to the state of a semi-fine powder, moisten this with half its weight of water, and lixiviate with water at 68° F., taking eare to pile the powder rather lightly. Heat the liquor in the water-bath ; strain, to separate the eoagulum whieh forms, and evaporate in the water-bath to the eonsistenee of an extraet.

From 100 parts of root I obtained 22.5 parts of extract.

WINE OF ELICAMPANE.

Take of Elicampane-root, 1 part.
White wine, 32 parts.
Alcohol of 56 C. (21° Cartier), 1 part.

Pound the root, add the alcohol, let the mixture stand for twenty-four hours, pour the wine over it, and let the whole maecrate for eight days ; strain.

Thirty grammes of the wine represent one gramme of the root.

ALCOHOLIC TINCTURE OF ELICAMPANE.

Take of Elieampane-root, 1 part.
Aleohol at 56 C. (21° Cartier), 5 parts.

Let the root maecrate in the alcohol for fifteen days ; strain with expression, and filter.

WORMWOOD.

M. Braconnot found in wormwood (Artemisia absinthium) :—

Volatile oil,
A very bitter resiniform matter,
A very bitter animalized matter,
Chlorophyle,
Albumen,
A peculiar starch,
An animalized matter of faint taste,
Some salts, and among others sueeinate of potass.

The volatile oil of absinthium has a dark green colour. It may be rendered colourless, however, by reetification over lime. The reetified oil boils at 392° to 401°. Its composition is the same as that of eamphor.—(Leblanc.)

The properties of the bitter prineiples are only imperfectly known to us. The one designated bitter resiniform matter imparts a bitter taste to eold water, although it is nearly insoluble in that menstruum. It dissolves more eopiously in boiling water ; the hot solution turns turbid upon eooling, owing to the separation and suspension of minute particles of the dissolved resin. It is soluble in alcohol ; water precipitates it again from the alcoholie solution. This matter remains undissolved when the alcoholic extraet of absinthium is treated with water.

The animalized bitter matter, on the eontrary, is soluble in eold water, and very sparingly soluble only in alcohol. The infusion of wormwood eontains both bitter matters, as the insoluble resiniform matter is made to dissolve in the boiling water by the presence and influence of the other prineiples of the wormwood.

Aecording to Mein, the bitter prineiple of absinthium is a colourless, partly amorphous, partly erystalline, matter, readily soluble in aleohol, ether, and the alkalis, and suseeptible of eombination with the metallie oxides.

This subject has not, however, as yet been sufficiently investigated.

In wormwood we have a combination of tonie and stimulating properties, owing to the assoeiation of the bitter prineiple with the volatile oil.

Wormwood is an excellent and most extensively used stomachie. It is also partly appreeiated as a good febrifuge, emmenagogue, and vermifuge.

The pharmaceutical preparations of absinthium are divided into three classes, viz. :—

1. Preparations which eontain the volatile oil alone.
2. Preparations whieh contain the fixed principles alone.
3. Preparations whieh eontain both the fixed and volatile prineiples.

§ I. PREPARATIONS WHICH CONTAIN THE VOLATILE OIL ALONE.

ESSENTIAL OIL OF WORMWOOD.

The colour of this oil is green, sometimes yellow ; its taste is aerid and bitter.

The extraetion of the volatile oil of wormwood differs in nothing from that of other volatile oils. It is given at the dose of 1 to 5 drops. On aeeount of its acridity certain preeautions are necessary in its administration. When intended for internal use it is mostly given in a potion, syrup, mueilage, or other vehicle ; this is done in order to guard against the too energetic impression whieh the pure oil would make upon the stomaeh. It is also used externally in frietions on the abdomen as a vermifuge. For the latter purpose it is mixed with from three to four times its volume of some fixed oil.

DISTILLED WATER OF WORMWOOD.

Take of Fresh wormwood tops, 1 part.
Water, a sufficieney.

Distil in the steam apparatus to draw off 2 parts of distilled water.

§ II. PREPARATIONS WHICH CONTAIN THE FIXED PRINCIPLES ALONE.

EXTRACT OF WORMWOOD.

Take of Dry wormwood tops, any quantity you like.

Reduce the tops to the state of a semi-fine powder, and moisten them with one half its own weight of water ; leave it in this state for two hours, and lixiviate, taking care to pile the powder rather lightly. Evaporate the liquors to the eonsistenee of an extract.

One part of the extraet represents the soluble matters of about four parts of the dry plant.

§ III. PREPARATIONS WHICH CONTAIN BOTH THE FIXED AND VOLATILE PRINCIPLES.

INFUSION OF WORMWOOD.

Take of Dry wormwood tops, 4 to 8 grammes.
Boiling water, 1,000 grammes.

Let the tops infuse in the water for one hour ; strain.

SYRUP OF WORMWOOD.

Take of Tops of wormwood, 1 part.
Boiling water, 8 parts.
Sugar, about 15 parts.

Let the tops infuse in the water ; strain with expression, permit the mechanically-suspended particles to subside, decant, and add to 100 parts of the elear liquid 190 parts of sugar. Make a syrup by simple solution in a elose water-bath.

This mode of preparation gives a syrup highly eharged with the bitter and aromatie principles of absinthium. It is a better product than that prepared according to MM. Henry and Guibourt's method, whieh eonsists in evaporating the infusion of absinthium and aromatizing the b iled syrup with the distilled water of the plant. Nor does the method of displaeement yield an equally satisfaetory result, because this latter method would require a much larger quantity of liquid for the total extraetion of the plant than is needed if infusion is resorted to.

The syrup of wormwood is specially intended for ehildren, who take it more willingly than any other preparation of absinthium.

20 grammes of the syrup eorrespond to about 1 gramme of the plant.

WINE OF WORMWOOD.

Take of Dry wormwood leaves, 1 part.
Generous white wine, 32 parts.
Alcohol of 86 C. (31° Cartier) 1 part.

Cut the leaves, pour the aleohol over them, let the mixture stand for twenty-four hours, and add then the white wine ; let the whole maecrate for two days ; strain with expression, and filter.

30 grammes of the wine eorrespond to 1 gramme of the plant.

ALCOHOLIC TINCTURE OF WORMWOOD.

Take of Dry tops of absinthium, 1 part.
Aleohol of 56 C. (21° Cartier), 5 parts.

Let the plants maeerate in the aleohol for several days ; strain with expression, and filter.

QUINTESSENCE OF ABSINTHIUM.

Take of Dry tops of wormwood,
" lesser wormwood, of each 2 parts.
Pounded cloves,
Sugar, of each 1 part.
Aleohol of 56 C. (21° Cartier), 32 parts.

Let the solid ingredients maeerate in the aleohol for eight days ; strain with expression, and filter.

This tincture is a popular stomachie.

WORMWOOD OIL.

Take of Dry wormwood tops, 1 part.
Olive oil, 8 parts.

Digest in the water-bath, strain with expression, and filter.

This oil has a fine green eolour. It is used in frietions on the abdomen as a vermifuge.

Dose, thirty to sixty grammes.

MUGWORT OR MOTHERWORT.

The leaves and tops of the mugwort (Artemisia vulgaris) are considered to possess

stimulating, emmenagogue, and anti-hysteric properties. Like all the Corymbiferæ, they contain both a volatile oil and a bitter principle.

They are frequently given in ptisan, at the dose of twelve grammes for a quart of water; but more frequently still in concentrated infusion, as clysters, with a view to react upon the womb.

Upon reducing the leaves of mugwort to powder there remains a downy residue, constituting a species of cotton, which is used for the preparation of moxas.

The root of the mugwort has been given with success in some rare cases of epilepsy and St. Vitus's dance, at the dose of four to eight grammes.

BRESLER'S ANTIEPILEPTIC POWDER.

Take of Powder of mugwort-root, 1 part.
Sugar in powder, 2 parts.

Mix.

Dose, one teaspoonful four times a day.

DISTILLED WATER OF MUGWORT.

Take of Fresh tops of mugwort, 1 part.
Water, a sufficiency.

Distil in the steam apparatus, and draw off one part of product.

SYRUP OF MUGWORT.

This syrup is prepared in the same manner as that of wormwood.

ROMAN CAMOMILE.

The flower of the Roman camomile (Anthemis nobilis) is exceedingly bitter. Previously to the discovery of bark it was considered the best febrifuge. It is still extensively used on account of its bitterness, and of the stimulating volatile oil which it contains. It is a popular remedy against the windy colic. The bitter principle of the camomile is soluble in water and in alcohol. The volatile oil is of a dark blue colour and viscous consistence. It turns brown upon exposure to the air.

INFUSION OF CAMOMILE.

Take of Roman camomile flowers, 4 to 8 grammes.
Boiling water, 1,000 grammes.

Let the flowers infuse in the water for one hour; strain.

EXTRACT OF CAMOMILE.

Take of Roman camomile flowers, 1 part.
Lukewarm water, two parts.

Reduce the flowers to the state of a semi-fine powder, and treat the latter with the lukewarm water according to Cadet's method; evaporate the liquor to the consistence of an extract.

Or you may resort to lixiviation, in which case the flowers are to be minutely chopped, moistened, and piled up very compactly.

The extract has lost most of the aromatic principle, but it retains the bitter matter of the camomile.

It is an efficacious remedy, which, however, is not much in use now.

The camomile yields the one fifth of its weight of extract.

CAMOMILE OIL.

Take of Dry camomile flowers, 1 part.
Olive oil, 8 parts.

Heat for a few hours in the water-bath; strain with expression; let the fluid clear, and filter.

SEMEN-CONTRA.

Semen-contra is the flower (not yet unfolded) of several species of Artemisia. It is attributed more particularly to Artemisia contra, judaïca, and glomerulata. It is an excellent vermifuge, which is given to adults at the dose of four to eight grammes. It is employed more particularly against lumbrici; a mild purgative is frequently associated with it.

According to Trommsdorf's analysis, Semen-contra contains:—

Volatile oil,
A hard resin,
Bitter extract.

Several observers (Kahler, Alms, Merck) have found in it since a crystallized matter to which the name Santonin has been given.

The resin observed by Trommsdorf has a dark greenish-yellow colour, and a bitter taste. It is friable. It fuses at 212° Fahr.; it is readily soluble in alcohol, in hot ether, and in the alkalis, but insoluble in essence of turpentine.

The essential oil constitutes eight parts of the semen-contra. It has a pale yellow colour, an acrid and bitter taste, and a sharp penetrating odour, somewhat analogous to that of mint. It is highly volatile.

Santonin has very remarkable properties. It is crystalline. The crystals are colourless and brilliant; their form is that of elongated quadrilateral tables. It has neither smell nor taste. It is volatile. It is insoluble in water, but dissolves in alcohol and in ether; the solution has a bitter taste. It dissolves equally in essence of turpentine. It combines with bases, and forms crystallizable salts with lime, baryta, and oxide of lead. When santonin is heated with an alkaline base, water, and alcohol, the liquid turns red, and subsequently, upon refrigeration, the new salt crystallizes in silky needles, which present at first a red colour, which they lose subsequently and turn white. This change of colour commences at the top of the crystals, and proceeds successively downwards. According to Liebig's analysis of santonin, this principle is a compound of:—

Carbon	79.51
Hydrogen	7.46
Oxygen	22.03

Professor Peretti looks upon it as an acid salt of potass (bisantoniate of potass). Kahler recommends the following process for the preparation of santonin:—Distil the ethereal tincture of the semen-contra. The residue is oleaginous; but the next morning crystals will be found to have formed, which may then be purified by a fresh crystallization. They are for this purpose redissolved in alcohol mixed with a little hydrochloric acid.

M. Merck proposes the following process:—Subject the semen-contra to the action of hydrated lime and alcohol. Evaporate the liquor to one fourth; filter to separate the resin. Evaporate now to dryness, and treat the residue with concentrated acetic acid, with the aid of heat: the santonin crystallizes upon the refrigeration of the solution obtained. Purify the crystals by solution in alcohol, and by charcoal.

Santonin is a most excellent vermifuge at the dose of 30 to 40 centigrammes. It seems to act as a specific against lumbrici; as it is almost tasteless, children take it without aversion; once arrived in the intestinal tube, it is dissolved by the influence of the alkaline secretions, and commences to act at once with great vigour and efficacy.—(Mialhe and Calloud.)*

CALLOUD'S SANTONIN LOZENGES.

Take of Santonin in powder, 1 part.
White sugar in powder, 40 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozengers of 1 gramme each.

Each lozenge contains $2\frac{1}{2}$ centigrammes of santonin.

POWDER OF SEMEN-CONTRA.

Pulverize the semen-contra without leaving any residue. Put the powder in a tight-stoppered flask, and keep this in a dark place. The powder of semen-contra is frequently mixed with the paste of biscuit or gingerbread, in order to facilitate its administration to children.

VERMIFUGE POTION.

Take of Semen-contra, 8 grammes.
Boiling water, 125 grammes.
Syrup of orange-peel, 32 grammes.

Let the semen-contra infuse in the water; strain, and add the syrup to the strained liquid.

ELÆOSACCHARUM OF SEMEN-CONTRA.

Take of Volatile oil of semen-contra, 6 drops.
Sugar, 4 grammes.

This formula is by M. Bouillon-Lagrange.

SYRUP OF SEMEN-CONTRA.

Take of White sugar syrup, 32 grammes.
Volatile oil of semen-contra, 2 drops.

Mix.

* For a greatly-improved method of preparing santonin we refer to last week's number (page 245)—"On the Preparation of Santonin. By M. Calloud."

ON THE CHEMICAL NATURE OF FATS AND WAX.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION OF GREAT BRITAIN, MARCH 9, 1849.

By B. COLLINS BRODIE, Esq.

So long as the chemist confines his attention to the great physical distinctions of the properties of different bodies, he feels no difficulty in bringing the result of his investigations before his hearers, because he is able to bring with his statements the demonstrations and experiments which he has previously made in his laboratory, which are at once the statement and the product of his researches; but when he comes to speak of the delicate differences of bodies resembling each other in outward qualities, and to describe their intimate relationship, the progress at which he was content to prosecute his labours in the laboratory is by far too tedious for an audience, and the experiments too intricate for the inspection of a large circle of observation. He can then only appeal for the acceptance of his assertions to the credibility he may have in any way gained with his hearers, and rather illustrates than proves the positions and conclusions it is his desire to establish. There is no matter more interesting than those intimate molecular relations of number which are observed to exist in, and in a great degree to characterize, great classes of natural bodies, and none more illustrative of the harmony and beauty of science. In the subject we shall consider this evening you will recognise a great type of organic investigation. Whatever interest attaches to this branch of inquiry attaches to the subject given out for this evening's discourse. Whether we will or no, chemical science has set in so strongly in this direction that we must make the election either, from time to time, to attend to investigations of this kind, or to remain in arrear of some of the most important truths of scientific discovery. In this theatre, from which the world first heard of metallic oxide, it is to be expected that an interest in all that concerns the advancement of science will prevail.

For the sake of clearness, let me point out the path in which I wish to lead you. I have to speak of the chemical relations of wax and fat. I have arranged certain groups of natural substances before you here. Fats, animal and vegetable, and waxes of various origin; and near them another class of bodies—alcohol, ether, and acetic acid—all different from the two first-mentioned substances; and I wish to show you the common origin and near relations of these seemingly distant bodies, and to call your attention to some generalizations on their chemical analogies. It is true that these intimate relations can only be made perceptible at once to the chemist, but their rational principles can be made intelligible to the moderately scientific without difficulty. The metamorphoses and changes which a body undergoes in form and in qualities by the addition or subtraction of this or that element are brought out in the series just named in a most remarkable degree. We shall first speak of fat. A fat is a body connected in our minds with certain general physical properties: your ideas on this subject I shall not seek to derange. Fats are of various origin; they are not all derived from the animal, but some from the vegetable, kingdom. The butter of cacao (Theobroma cacao), of nutmeg (Myristica moschata), of laurel (Laurus nobilis), for instance. Spermaceti, found in the head of Physeter macrocephalus, is a substance distinguished from all other animal fats by marked qualities. I wish merely at present to bring before your minds the fact that there are a great number of fats; but for the sake of limiting our views I shall speak of only one fat: this shall be butter, which will give us an opportunity of

glancing at the organic substances contained in milk.

Milk is a body containing different ingredients, which, as we all know, separate in a short time, if the substance is left to itself, into solid and fluid parts, when the milk becomes sour. The change thus effected in time naturally we can bring about by artifical means instantaneously. When milk is mixed up with a certain quantity of alcohol, and the mixture shaken, the solid separates immediately from the fluid part: the latter is almost entirely water, the former is a mixture of various bodies. When we filter this substance the water passes through with a certain amount of alcohol, which remains at the bottom of the vessel; the solid part of milk remains on the filter as a sort of cream, and another chemical substance, called caseine in its pure state, and cheese as it is, is commonly met with.

Besides cream or butter, caseine, and water, milk contains a sugar, which is called by chemists sugar of milk. The proportions in which these substances are combined are not uniformly the same, but they may be stated generally thus for 100 parts:—

Butter	3
Sugar of milk	4.6
Caseine	5.1
Water	87.3
	100.0

We may effect another kind of separation of the solid part of milk. When this substance is left to itself a certain number of the solid parts rise to the surface as cream; this takes place because the solid substance is specifically lighter than the fluid. It consists of butter and globules of caseine; and we know at present of no better mode of preparing butter than by breaking up or striking these globules. Butter when well washed loses its colouring matter, and in its pure state has the appearance of a white fat. Butter, like all other fats, is separable into its more solid and more fluid parts. This can be effected in the present case, as with fats in general, partly by pressure and partly by the use of suitable solvents. When this has been accomplished for other fats, we have a number of solid substances, varying in their character. The solid part of tallow is stearine, from which candles are very extensively made. Now, the solid part of butter goes under the name of margarine, a body which in its pure condition has a beautiful appearance and a crystalline form, and from the pearly nature of its acid it derives its name. Whenever we eat butter we eat this solid, pearly, crystalline body. Now as to the chemical nature of this margarine. The great chemical experiment which has thrown light on the nature of fats is their saponification. When we take a fat, this bit of butter for example, and place it in a certain water, it simply melts; if, however, we mix with the water a certain portion of alkali a further change takes place, and the substance loses its fatty nature. The butter, or other fat, undergoes decomposition through the presence of an alkali and water, it is gradually dissolved, and salts of potash, if potash was the alkali used, are formed. If we throw in a small portion of common salt the solid substance separates. This is soap. But if, instead of throwing common salts, we add an acid, a substance having the appearance of the original fat would separate and float on the surface, the water having the appearance of an oil or fat. Now, this body is not the original margarine, but margaric acid. It is a beautiful crystalline substance. Its chemical nature is given among the acids in the table lower down. The foregoing is not the only change fat undergoes by saponification. There is yet another substance, called glycerine, of a viscid consistence and sweet taste, combined with margaric acid. This is conveyed off in the mother liquor in the process of saponification.

The subjoined table may now be introduced, as it will frequently be necessary to refer to it in the course of this lecture. The column on the right exhibits the volatile acids of fat; the centre column its solid constituents; and the left the fluids of fats:—

ALCOHOLIC SERIES.

HYDROCARBONS. Cm. Hm.	ALCOHOL. $Cm.\ Hm_2.\ O_2.$	ACIDS.	
	Wood spirit $C_2\ H_4\ O_2$	Acetic ..... $C_4\ H_4\ O_4$	
Etherene (Olefiant gas) $C_4\ H_4$		Metacetonic .. $C_6\ H_6\ O_4$	
		Butyric ..... $C_8\ H_8\ O_4$	Volatile acids of butter.
	Alcohol .. $C_4\ H_6\ O_2$	Valerianic .... $C_{10}\ H_{10}\ O_4$	
Amilene ..... $C_{40}\ H_{40}$		Caproic ..... $C_{12}\ H_{12}\ O_4$	
		Œnanthylic .. $C_{14}\ H_{14}\ O_4$	
	Ethal .... $C_{32}\ H_{34}\ O_2$	Caprylic..... $C_{16}\ H_{16}\ O_4$	
Cetene ..... $C_{32}\ H_{32}$		Capric ..... $C_{20}\ H_{20}\ O_4$	
		Lauric ..... $C_{24}\ H_{24}\ O_4$	
	Cerotin .. $C_{54}\ H_{56}\ O_2$	Myristic..... $C_{28}\ H_{28}\ O_4$	
		Ethalic ..... $C_{32}\ H_{32}\ O_4$	Acids of wax, spermaceti, and fat.
Ceroten ..... $C_{54}\ H_{54}$		Palmitic .... $C_{32}\ H_{32}\ O_4$	
	Melissin .. $C_{60}\ H_{62}\ O_2$	Margaric .... $C_{34}\ H_{34}\ O_4$	
		Stearophanic.. $C_{36}\ H_{36}\ O_4$	
Melen ..... $C_{60}\ H_{60}$		Behenic ..... $C_{44}\ H_{44}\ O_4$	
		Cerotic ..... $C_{54}\ H_{54}\ O_4$	Acids of wax.
		Melissic..... $C_{60}\ H_{60}\ O_4$	

Now let us pay attention to the fatty body, to whose nature the preceding remarks have been introductory. The form in which *wax* most generally comes before us is as the cell of the bee, which, as all know, is that structure which serves as the depository of the honey. Wax, then, in its natural condition consists of a number of minute particles built up into cells, and cemented by oil. It is when this structural arrangement has been destroyed, and the particles agglomerated after melting, that the chemist regards it. When the wax is shaken up with water or some other dissolvent, the more oily part separates. Wax, like fat, is a substance much more abundant in nature, and of more various origin, than many of us suppose. It exists as a vegetable product, it forms a part of the green fecula of many plants, and perhaps of the pollen of flowers; the fine bloom on the skin of the plum and grape is nothing but wax. It is obtained from the berries of the myrica angustifolia, latifolia, and the cerifera. On the table are specimens of many of these variously-derived species of wax, but their appearance presents nothing to distinguish them from the ordinary wax of the bee. From this ascertained existence of wax in plants a most curious question has arisen. We know that the bees derive the elements of the honey from the plants on which they feed; and the question has arisen whether the insect in like manner derives wax from the plant, or whether that substance is formed in virtue of the modifying faculty of the bee. Now, it has been found by direct experiment that the true origin of wax is in some substance in the bodies on which the bee feeds; in other words, that the wax is made by the bee out of the honey or sugar on which it lives. A gentleman anxious to solve this question shut up bees by themselves, and gave them access to nothing but sugar, and the bees, although at first reluctant to this mode of living, did at last acquiesce in it, and lived a considerable time on sugar alone, and made wax out of it. It would seem that the bee is not the only wax-making insect. I have here a specimen of a curious substance imported into this country for commercial purposes, as a material for making candles, in fact; it is brought from China, and resembles spermaceti. I think it has been proved to be a wax, chemically speaking; and it is, I believe, the produce of a very small insect. I am endeavouring to procure more information on this subject. Sir George Staunton, in the account of his embassy to China, says that the insect making this wax is about the size of the common ant. It is said that the entire bodies of these ant-like insects are covered with fine particles of dust, which is nothing else but wax. I believe that is the form in which the wax appears; and I also have seen a specimen of a vegetable wax from Brazil which does come before us in the form of dusty particles. It may be that the bee sheds its wax in like manner. Now, both the beeswax and wax from China have been examined, and in the latter part of this discourse I shall have to speak of the peculiar interest attaching to the result of these inquiries. The great difficulty by which any investigation of the chemical nature of wax is accompanied arises from the fact that it is a very complex substance, unlike butter, from which we can detach first one constituent, and then another, by a succession of comparatively simple decompositions.

The first substance which we notice as existing in beeswax is *cerotic acid*. It is a highly crystalline body, and melts at about 78 C. Its chemical formula is given in the table, $C_{54}\ H_{54}\ O_4$. 100 parts, therefore, consist of—

Carbon	79.02
Hydrogen	13.17
Oxygen	7.81

This acid is a very volatile substance, and in the wax I examined it constituted 22.0 per cent. of the entire substance. There is reason for supposing that it exists in the same proportion in every species. The crystalline form, it may be noticed *en passant*, is not of unusual occurrence in fats. Stearine, and also spermaceti in its pure state, are of crystalline form. It would be improper to say that cerotic acid is formed out of beeswax: it exists in it as a natural element. The existence of this acid in wax in a free state is a fact to which we have no parallel in the constitution of any known fat, and but for the complicated nature of wax it would be surprising that its discovery should have been so long delayed.

Another substance found in wax has long gone under the name of myricine. In appearance this body is like margarine. When we saponify the substance, by boiling it in a solution of potash, myricine breaks up into two parts, an acid analogous to margaric acid (palmitic acid, $C_{32}\ H_{32}\ O_4$), and another body, having the composition $C_{60}\ H_{62}\ O_2$. Another substance is cerotine, $C_{54}\ H_{56}\ O_2$, and the cerotic acid of which I have before spoken. Thus the decomposition of wax by potash gives the following numbers:—

Cerotine	$C_{54}\ H_{56}\ O_2$
Cerotic acid	$C_{54}\ H_{54}\ O_4$
$C_{108}\ H_{108}\ O_4 + 2HO =$	$C_{108}\ H_{110}\ O_6$

Chinese wax.

Mellissine	$C_{60}\ H_{62}\ O_2$
Palmitic acid	$C_{32}\ H_{32}\ O_4$
$C_{92}\ H_{92}\ O_4 + 2HO =$	$C_{92}\ H_{94}\ O_6$

Myricine (beeswax).

Acetic acid	$C_4\ H_4\ O_4$
Olefiant gas	$C_4\ H_4$
Acetic ether	$C_8\ H_8\ O_4$

The most interesting point about this wax and other fats is their strong resemblance,—indeed, their essential identity,—with common alcohol and common vinegar. A person unacquainted with chemistry might very reasonably ask what analogy can there be between substances so dif-

ferent in appearance as the waxes and fats, and vinegar and alcohol? Nevertheless, the analogy is strong. Suppose we have two examples of chemical structure which I wanted to bring before you, two substances of the same chemical formula, one much larger and heavier than the other, there would be a certain resemblance if I could show you that they both broke up into similar forms,—that when struck in one direction both broke up into triangles, in another both into cubes, in another into octahedrons, &c. You would admit that there must be something more than outward appearance to justify the affirmation of resemblance, and you would predict their similar molecular structure.

Now, the chemist has many ways of breaking up chemical substances: all his decompositions are directed to break down the structural arrangement of molecular particles, and to rearrange them according to their elementary properties. If we take alcohol and heat it sufficiently, we can oxidize it by burning, and convert it into gas and water; but it is possible to oxidize alcohol in a very different manner. We may make it pass into acetic acid or vinegar by removing two equivs. of hydrogen, and bringing in two of oxygen. Of course we can do this by various actions of oxygen. In this case I will use platinum in a very fine state of subdivision. In this state it has a peculiar facility of causing the union of some other bodies, among which are oxygen and hydrogen. When into a current of oxygen we let fall a little of this black powder in the air, combination between oxygen and hydrogen takes place at the numerous surfaces of the platinum, and a heat is developed sufficient to ignite the hydrogen and cause combustion. We do not know the reason of this curious reaction, but so it is. Simple contact is all that is required to produce this singular effect. Now, when we bring platinum powder in contact, not with hydrogen, but with the vapour of alcohol, a curious oxidation of alcohol takes place. I have a tube here containing a little cotton which I will moisten with alcohol, and will leave the cotton in the tube, but accompanied with a small proportion of oxygen gas obtained from platinum. From the oxygen in the apparatus I send a small current through the tube, and not only will the alcohol be acted on by the platinum, but the action is so strong as to cause ignition. Now, the ultimate result of all this is that acetic acid or vinegar is formed,—the ultimate result, because in the course of the process an intermediate substance is produced, which disappears before the process is concluded. We satisfy ourselves of its presence by holding a little blue litmus paper before the end of the tube, where it immediately reddens. We have a more effectual way, however, of oxidizing alcohol, and of making it pass at once to the condition of an acid. One of these means is the action of vapour of alcohol on caustic potash. In this case the water is decomposed, and the proof of oxidation is the liberation of hydrogen gas. Now, when I make one of these waxy substances solid in the presence of caustic potash, the solid substance passes into an acid, standing in the same relation to the waxy body as acetic acid does to ordinary alcohol. This is the first point of resemblance of both bodies. Wax and alcohol pass by oxidation into one acid. I now come to another. I have in this bottle a fluid which goes under the name of acetic ether, containing, or composed of, acetic acid and ether. It possesses a very aromatic odour, and gives their peculiar refreshing scent to Rhine wines. Between this substance and wax the analogy is even stronger. The first point is that we get at the acetic ether by the saponification of alcohol, and that from the waxy substance we can form alcohol. In the subjoined diagram is given the action of heat on these different bodies:—

DECOMPOSITION BY HEAT.

Cerotic acid	$C_{54}\ H_{54}\ O_4$	Palmitic acid	$C_{32}\ H_{32}\ O_4$
Ceroten . . .	$C_{54}\ H_{54}$	Melen	$C_{60}\ H_{60}$
Chinese wax	$C_{108}\ H_{108}\ O_4$	Myricine	$C_{92}\ H_{92}\ O_4$

Olefiant gas	$C_4\ H_4$		
Water $2HO$ =	$H_2\ O_2$		
Alcohol	$C_4\ H_6\ O_2$		
Ceroten	$C_{54}\ H_{54}$	Melen	$C_{60}\ H_{60}$
Water $2HO$ =	$H_2\ O_2$	Water $2HO$ =	$H_2\ O_2$
Cerotine	$C_{54}\ H_{56}\ O_2$	Melissine . .	$C_{60}\ H_{62}\ O_2$

These are products of the distillation of wax. Now, the products of the distillation of acetic ether are vinegar and olefiant gas. We have been for the last few minutes collecting these products, the former in the apparatus, and the latter in ice, from the arrangement on the table, when a small quantity of acetic ether has been heated in a retort by means of a spirit-lamp. We have now sufficient olefiant gas, and, on applying a light to the jet, the gas burns with a very luminous white flame. I am not now pointing out a common chemical relation of substances. We now know thousands of organic bodies, and yet but in very few indeed is this curious chemical relation subsisting. On the diagram headed "Alcoholic Series" we have arranged the hydrocarbons, alcohols, and acids. On casting the eye over the list of acids we find waxes containing 60 equivalents of carbon, between which and the acids of fat, containing but 32 equivalents of that element, there is a wide difference. The series of acids is not yet complete. Of the alcohols we know but six: the two last on the list, containing the largest proportion of carbon and hydrogen, are waxes. In this series we have a chemical system more or less complete, a type after which all things must be modelled. We can hardly doubt but that these hydrocarbons are parts of a much larger system, and that all the gaps at present visible will be filled up. There may be in nature a great variety of systems; we are not to suppose that there must needs be but one law of arrangement; there may be the same diversity here consistent with harmony as there is a difference and variety in the bodies to which the laws of nature apply.

There are many considerations which suggest themselves upon reflection on this series. I will mention two, the first having reference to the physical nature of these bodies.

Between a certain number of bodies, characterized as fats and wax by their outward appearance, it is but natural to expect there should be a simple chemical relation; but what if alcohol should turn out to be nothing but a fluid form of wax? Alcohol, I believe, is only a fluid fat. We are told by one chemist that wax is a fluid; and you all know there are various reasons for thinking that hydrogen, after all, may be nothing but the vapour of a very subtle matter at present unknown to us. Alcohol, it is true, has hitherto resisted all attempts to solidify it, but it has been rendered viscid. A gentleman who has succeeded in this experiment told me that it looked exactly like melted white wax. The number of bodies which pass through the viscid to the solid state is very small indeed. My other remark has reference to the much-debated question—the molecular origin of fat in the animal system. Some chemists have thought that fat is taken up by animals in their food, and thus passed into the system, just as all the ingredients of plants are taken up, each plant having its own particular food. Others have thought that fat has its origin in one particular kind of food, and sugar has, for various reasons, been fixed on by Liebig and others. Is it not curious that when we examine the chemical nature of these bodies on the large diagram we do find among them substances identical with those which we can make out of sugar? Ordinary alcohol is produced from alcohol by fermentation. Grape-sugar contains the elements of alcohol and carbonic acid with water, in the proportions of two, four, and two. When a solution of this sugar in water is exposed to the action of a ferment the sugar soon disappears, carbonic acid is given off, and alcohol is found in the liquid, and may be separated from it by distillation.

Some chemists will very much extend our knowledge of the relations of the components of this series, and especially that the transformations of sugar will assume an importance for which only those are prepared who have closely studied the affinities of substances of the alcoholic series.

ILLUMINATION BY ELECTRICITY.

A LECTURE DELIVERED TO THE MEMBERS OF THE PHARMACEUTICAL SOCIETY, MARCH 14.

By THEOPHILUS REDWOOD, Esq.

The proposal of plans for the application of electricity to the purposes of common illumination has had the effect of directing public attention very much to the conditions under which the luminous properties of that power are brought out. The realization of the suggestions which have lately been made would, perhaps, be the greatest triumph of science since that achieved years ago by the application of coal-gas for similar objects. The electric light has been known for many years, and has frequently been exhibited in places of scientific resort: its purity and intensity have excited the admiration of all who have seen it. Several schemes have been devised for making this beautiful light available for general use, but the obstacles to be encountered have proved too formidable.

Within the last few months, however, the subject has gained new interest, from the announcement that methods have been discovered which remove those obstacles, and enable the parties making the announcement to render electricity the source of a useful and economical light. We are told ere long that our streets and dwellings will have exchanged the jaundiced light of gas and wax candles for a brilliant light which rivals the sun for purity and power. Several patents have been already taken out for the arrangements by which this adaptation is to be effected, companies have been projected for raising the one thing needful, and the doubts of the cautious and incredulous have been shaken by the exhibition of a splendid certainty. To inquire into the previous state of our knowledge of this light, and to notice the proposals that have been lately made,—to distinguish what has been really accomplished from that which is only hoped for,—is the object of this lecture. I propose prefacing my remarks with some observations on the nature of light and the sources of light, of which electricity is one, bearing in mind that the lectures delivered here are intended for a class who are not always freely conversant with those points. Light, however, evolved is a force or agent by which we are able to receive impressions from external objects through the organs of sight. It produces upon the exterior of the eye the sensation of vision. Some philosophers have considered light to be a distinct form of matter thrown out or radiated from luminous objects, transmitted or reflected in various degrees by the substances on which it impinges. This is the substance of what is called the corpuscular theory. By others, however, light has been viewed, not as a separate kind of matter, but as merely a state or condition of matter, such as a state of vibration or motion. This is the undulatory theory. Among those who support it there are some who think that the vibrations causing light are confined to a distinct kind of matter, an ethereal fluid of extreme tenuity which pervades all space, while others reject this notion and consider light as a specific condition, like heat or motion. We have one great source of light by which we are directly illuminated in the day; but civilized man neglects the beneficent gift, and slumbers away in neglect of its cheerful beams, delighting rather to revel in the reflected brightness of artificial light. Artificial light, however, is a necessity in a civilized state of society. It does not fall within my present design to trace the progress of artificial illumination; suffice it to say, that all the methods of producing light which we are accustomed to employ depend on the chemical combination of bodies. We cannot

light up a eandle, a jet of gas, or a lamp without produeing combustion and chemieal combination. The elements of the candle combine with the oxygen of the surrounding air, and the light in these eases results from chemical combination. It is one of the attendant phenomena of the combination thus produced that heat is simultaneously evolved. We have reason to believe that the development of heat always accompanies ehemical eombination, but we eannot assert this of light. The same bodies may be made to combine under different circumstances in one ease with the development of light in the other entirely without that phenomenon. For instance, if we take a mixture of hydrogen and oxygen, and introduce into it a piece of spongy platinum, we cause eombination sometimes with an explosion, but always with the emission of light. Combustion occurs, the gases combine, and light is seen. If we take a similar mixture, and into it introduee with platinum a piece of clay, combination occurs, but this time without the development of light. When light is one of the phenomena combination takes place with great rapidity, while in other eases it is slow. The production of light by chemical eombination is generally, though not necessarily, accompanied by the development of a eonsiderable amount of heat, eombustion being at the same time rapid and energetic. In the experiment just shown the platinum beeame incandeseent from the heat developed. The exeeptions to this remark are in the several cases of phosphorescence, which are attended with a very slow combination and slow evolution of heat, almost, if not quite, imperceptible. Now, when heat and light are evolved, the aggregate effect eonstitutes the phenomena of combustion, in the ehemieal sense of the term. It is by combustion that the light under which we sit is artificially produced; and the means employed to produee nocturnal illumination are dependent on its laws, which are those of chemical affinity. But light may be produced independent of combustion, as, for instanee, where a body becomes luminous through the aeeumulation of heat; in this way light may be proeured in abundance, and no ehemical combustion take place. A piece of metal may be made first hot and then luminous by being hammered on an anvil, and in this ease no ehemieal eause is aetive. Bodies thus luminous in virtue of the accumulation of heat are said to be incandeseent. In fact, to make combustion a valuable souree of artifieial light, it is neeessary that the flame should contain solid matter in a state of incandescence. Flame is generally produced by the combustion of gas or solid bodies conyerted into vapour. The light emitted from gases or vapours is generally feeble. This is the ease with the hydrogen flame; when we light a jet of hydrogen and oxygen gases eombined we have a flame giving an intense heat, but at the same time scarcely any light. Now, the combustion is perfect here, and the affinity by which the gases unite is exceedingly strong; we ean in this flame fuse the most intraetable metals, and effect the vivid combustion of sueh metals as iron. Let us now alter the eonditions by fixing a piece of some solid incombustible body, lime for instance, in the flame. In this case we observe, in the first instance, that when the jet of mixed gases is ignited we have little light and intense heat, and the other phenomena attending combustion; but upon introducing the lime into the flame we find that the intense heat renders the lime ineandeseent, and the quantity of light is greatly increased. This light is quite equal to the electrie light in purity, and is, perhaps, even purer. Light then, in this ease, results from the ineandeseence of a solid body situated in the flame. Now, in obtaining an illuminating flame from candles, oil, or gas, we have conditions to be fulfilled similar to those already realized in the lime. We have to bring two gaseous bodies capable of combining into contact at an elevated temperature, and the arrangement must be such that one substance, namely, earbon, shall be made incandescent in the solid, and then beeome luminous in one part of the flame. This may be illustrated by means of one of Mr. Leslie's burners, furnished as it is with three kinds of chimneys for the purposes of my experiment.

Mr. Leslie's own ehimney is eonstructed with a view to adjust preeisely the supply of air to the materıal to be burnt. When I plaee it on the burner a white light is the consequenee. The supply of gas I leave unaltered in the various glasses. In the first, from the due admixture of atmospherie air and the hydrocarbon, we get a very white light. I take the ehimney off and replace it by the eommon old eylindrical glass, and the supply of gas sinks immediately; too mneh atmospherie air has been admitted; the solid earbon, instead of becoming ineandeseent, is converted into gas, and yields no light. I remove the glass, and place on the burner another, which admits an insuffieient supply, cooling the gas flame, depriving it of power to heat the earbonaeeous partieles, whieh now fall out unconsumed as soot; we have a smoky flame.

Thus with the same consumption of gas, the same combination of two gases, but with different arrangement for burning it, the yield of light is greatly varied. That is the second point to which I ask attention. Such are the conditions of procuring light by means of eombustion, for the fulfilment of whieh very many modifications of arrangements have been introduced as lamps. A great number of these inventions are eonstantly brought under our notiee, all laying claim to some superiority with reference to the arrangements adopted for effecting eombustion; and it is very important that their merits should be judged by a proper standard, sinee we have seen how great a variety of results flow from the arrangements adopted. As compared with those who lived under the reign of mould eandles, we may eongratulate ourselves on the possession of abundant means of obtaining a pure and eheap light. As compared with the progress of art and scienee, the best eandles and purest wax yield but an impure light; and the remaining means of illumination are open to objeetions, as injuring the atmosphere of our houses and the health of their inmates. Now the votaries of scienee are ready to apply its resources for removing the evils of this system, how is the objeet we speak of to be attained? The means of produeing a light pure in its quality, produeible or available at will in any required quantity, without prejudice to the condition of our atmosphere, how is all this to be obtained? It has been asserted that it is all possible by means of eleetrieity. Some years ago the knowledge of eleetricity extended no further than to the means of drawing faint sparks frem glass; and more reeently an eleetrie discharge, momentary in its duration, was all that art eould do or science show on the subject. The suggestion that this terrible agent would one day be made use of as a souree of light might then well be a subjeet of ineredulity or scientifie wonder. But the day of the galvanie battery as a sourse of eleetricity was at hand; with this small but perfect apparatus we are enabled to command as much electricity as would supply a hundred thunderclaps. We have it here under our command ready to go forth as the bearer of intelligence at the speed of two hundred thousand miles in a seeond of time, and exerting a powerful influence on different forms of matter, or in the chara eter of fire melting the most intraetable metals, and under eertain eireumstances produeing a most splendid light. It is eleetricity of this kind whieh has been proposed to be applied to purposes of illumination. But here we may profitably inquire what is this eleetricity? whenee does it originate? and how does it produce these effects? In answer to the first question we might represent electricity as a force or power closely allied to, if not identical with, chemical affinity, or a power which eauses bodies to enter into chemical combination. In accordanee with the views of some philosophers it might be represented as a specifie mode of aetion of a eertain foree or power which otherwise manifested itself as ehemical affinity, heat, light, or magnetism. Or, again, it may be that, as Mr. Grove has suggested, heat, light, electricity, and magnetism, are eorrelatives, and have a reeiprocal dependence, so that one could not be without the other, so that neither ean be the essential or the proximate cause of the others, but they are reproduced or convertible into each other. These are merely speculative opinions on a subjeet with reference to which we have no means of obtaining either eertain or precise information; they tend, however, to show that eertain close relations have been observed between the different forms of physical forees, and in this view alone I adduce them. But whenee does this power originate? how does it come into action? It is developed in the battery from chemical eombination and decomposition; it is produeed or put into action by the acids of the liquid and the combination of one of the elements with a metal. Eleetricity, indeed, is put into aetion in every case of chemical deeomposition and combination, but it is not in every case of the kind that we get an eleetrie enrrent, a manifestation of the foree at a distance from the point at which aetion occurs; and when the phenomena are eonfined to one loeality these are ealled purely ehemieal. But when some phenomena are transferred to a distance the effeet is said to be electro-ehemical, electricity being one of the forces thus transferred. Now, the condition essential to the transfer of a part of the force put into aetivity on the chemical combination or decomposition of bodies appears to be that two conduetors of electricity shall be simultaneously exposed to the aetion of a eompound liquid, of which one of the elements has a stronger affinity for one of the conductors than the other. The conductors must be separate from each other in the liquid, and be connected by a eonductor of eleetrieity out of the liquid. This is the constitution of the galvanie eireuit, and an alternation of sueh arrangements constitutes the galvanic battery. It results, then, that this is an arrangement for developing the force involved in the deeomposition of bodies, rather than a method of exciting a distinet force of eombination or eombustion. In the flame of a eandle we may assume that we have all the operating forces more distinctly and more separately developed in and by the battery; we have a eombination of wax or tallow, and eombination of some of its elements with oxygen, heat and light being developed. In the galvanic eireuit we have decomposition of water, or acid, or a saline eompound, and combination of one of the elements with a metal. It is the absenee of local phenomena, and the manifestation of the effects of eombination and decomposition at a distance, that distinguish voltaie eleetrieity from chemical action. This differenee is not sueh as to form an essential distinetion between the two forces involved in these cases.

It is universally aeknowledged that all bodies whieh eombine ehemieally are respeetively in a positive and negative relation to eaeh other. This was the case in the oxyhydrogen flame whieh we lately saw. Oxygen and hydrogen are positive and negative in their eleetrical relations. In the flame the effeet of the two eleetrieities has only been at onee to neutralize each other; but in the eell the two were separated, and their effects were transferred to a distanee. Now, it is not my intention to assert that the oxyhydrogen flame, or that any other flames, are the result of two opposite eleetrieities, yet some arguments may be added in favour of this view.

Hydrogen and oxygen may be made to combine without the evolution of light. We have seen how they eombine with evolution of light, and in this ease the electrical action is neutralized, and local aetion takes plaee; but if we proceed in a different manner

to effect combination, and take, for instance, a Grove's gas battery, in which the combination of oxygen and hydrogen takes place without flame or light, we have the same results occurring as in the oxyhydrogen light, as far as combination (but not local combustion) is concerned, and we have not the light developed where the action occurs. The electricities, instead of being neutralized at once, or combining locally, are transferred to a distance. In Grove's battery electricity is developed by the combination of oxygen and hydrogen, and a force is developed which, under management, produces all the phenomena of the combination of oxygen and hydrogen. In flame we can get heat, light, and the decomposition of water itself.

It is well known that if charcoal be thrown into fused nitre, at an elevated temperature, the former will ignite, and a vivid combustion, at the expense of the oxygen of nitric acid, occurs, and heat and light are evolved. If, however, the temperature of the nitre be not sufficient to keep it fused on introducing the charcoal, fusion will take place without the evolution of heat and light, and carbonic acid will be produced. Now, when the conditions are such that the nitre is not ignited, and no light or heat is produced, we get a deflection of the needle; but if the temperature is high enough to produce incandescence we get no deflection of the needle. This view may, perhaps, derive some corroboration by the influence of the magnet on the flame; but before noticing this let us explain the relation of magnetism to electricity. We have seen that, while the current of electricity is made to pass near to a magnetic needle, the needle, which had previously taken up a position under the influence of the earth's magnetism, pointing nearly to south and north, will take up a position at right angles with the line of the electric current; so also, in like manner, if the wire conveying the electricity were mobilized and the magnet fixed, the wire would take up a similar perpendicular position to the magnet. Hence we conclude that the two powers are tangential to each other. If we place the flame of a candle between the opposite poles of a horseshoe magnet the flame alters its character, and, instead of taking its usual form, it burns in the shape of a fishtail. I do not wish to lay stress on these last particulars, for they have been explained with reference to an electrical axis on the flame, but they form part of the facts that may be adduced as showing the connection between ordinary combustion and electrical phenomena. But to return to the battery—this is our source of electrical power. We recognise in it an arrangement for the chemical combination or combustion on which we depend for a supply of electricity, and the quantity we get will depend upon the extent of chemical action going on in the battery. The battery contains two solid conductors, generally both metallic, but not always, charcoal being sometimes used as a conductor. These conductors are immersed in a liquid, generally an acid. One of the conductors enters into combination with some element of the positive liquid, the other conductor meanwhile remaining passive. Zinc is usually the metal which enters into combination. We derive the power of the galvanic battery thus partly from the combination of zinc with oxygen or some other element of the exciting liquid. The improvements which have been made in galvanic batteries have mainly had reference to the constancy and uniformity of their power. In no battery can we get power except as it is represented as going on in the cells: the amount of zinc consumed in the cells is the measure of the power produced and transferred. As, when we ignite a piece of zinc in flame, we get combustion of the zinc and a certain amount of power proportioned to that combustion, so in like manner the power we get from the battery will be equivalent to the amount of zinc consumed there; in order to increase the power we must increase the work done in the cells. Now, there are two ways of increasing the power of the battery: one is by increasing the quantity, the other by heightening the intensity, of the electricity. In a good battery the quantity of electricity generated depends on the work done in each separate cell, and the intensity upon the number of cells. When the two plates are immersed in the exciting liquid the action commences in the positive metal, and from this the electric current starts. The other element is not chemically acted upon, but, being electro-negative, it enters as electro-polar condition all the particles of the decomposing liquid. A polar chain is thus established, which in a battery of several cells runs through them all. The quantity of electricity is according to the amount of work done in any one cell, and not in the aggregate amount of the whole. But a battery may be put into action with a great quantity of electricity, and its real power be, nevertheless, very feeble. It has quantity, but it wants intensity, of action. The intensity of the current depends on the number of cells in the battery. The distinction between quantity and intensity in electricity may be appreciated through the following description by Faraday:—"Two wires, one of platinum and the other of zinc, $\frac{1}{18}$ inch in diameter, are immersed to the depth of $\frac{5}{8}$ of an inch in a mixture of one drop of oil of vitriol and four ounces of water; as much electricity is set free in three seconds as is yielded by an electric battery of Leyden jars having 3,500 square inches of erected surface, and charged by 30 revolutions of a plate-glass machine 50 inches in diameter." Was I, then, wrong in saying that we have in the battery as much electricity as would suffice to charge 100 thunderclaps? But the intensity of the electricity of the battery and of a flash of lightning are entirely different. For the purpose we are contemplating it is not only necessary to have a large supply of electricity in the battery, but we must have it in considerable intensity; and, further, to fulfil all the conditions at present known, we stand in need of the best form of battery which has been, or can be, devised.

On the present occasion I am surrounded by specimens of all the best batteries hitherto contrived and best suited for producing the light and other effects requiring intensity, and quantity, and constancy of supply. Of these the most deserving to be first mentioned is Daniell's constant battery. The improvements effected in this battery must be said to have furnished the principles upon which all our most powerful batteries are now constructed. In this battery, which is a type of most others, two exciting fluids are employed, one in contact with the negative, and one with the positive, conductor; the two fluids are separated by a porous diaphragm, which does not prevent the continuity of the polar chains. The exciting fluid acting on the zinc is a mixture of one part sulphuric acid and eight of water. The copper and zinc plates are connected by a wire. When the zinc plate decomposes the water, its hydrogen, influenced by the directive force of the positive current, passes through the diaphragm towards the copper plate, and aids the decomposition of the sulphate of copper which is in contact with the copper; it unites with the oxygen of the oxide to form water, and the copper is set free.

The invention of Daniell's battery was soon followed by the introduction of Grove's, which has now almost entirely succeeded Daniell's. At the present day there is no form of battery known combining so many good qualities as Grove's. It is constantly resorted to for producing striking effects. Platinum is used instead of copper, and nitric acid is the electrolyte. On the Continent Bunsen's battery is very much used. In this battery cylinders or plates of charcoal are substituted for the expensive platinum. Lately we have had a battery called the "Maynooth Battery;" the liquid elements are the same as Grove's and Bunsen's, nitric acid and dilute sulphuric acid; but the negative conductor is formed of iron. When in order it yields great power, and develops a vast amount of electricity; but I fear it will be of very little service; it is exceedingly liable to get out of order, and is then utterly useless.

Now, having described the properties of these batteries, let us consider their uses. The power gained by the action going on in the cells is transferred through the conducting wires. There are various ways of showing that this is the case if the conducting wires are good conductors. I shall have indications afforded by my needle. In the first instance I propose showing the manner in which a combination of Grove's, Bunsen's, and the Maynooth battery, of twenty cells of the first, twenty of the second, and ten of the third, yields electricity. (The light exhibited.) This is the kind of effect intended to be a source of illumination to our streets, shops, and dwellings, resulting from the combination of the elements in the trough and the presence of an imperfect conductor in the circuit, by which electricity is arrested, in order to make it perform this office. In the first instance I am compelled to bring these charcoal points into contact, and having done so I may recede them, gradually allowing them to remain a short space asunder. In this way the electric light is produced by the transfer of particles of carbon or charcoal from one of these electrodes, and an imperfect communication is maintained by the passage of minute particles of charcoal in a state of incandescence. It is perfectly pure, so much so that the gas-lamps look dim, and actually seem to detract from our sum total of light, showing how impure the light of our gas is.

By means of a lens I may show the prismatic colours of the spectrum on the ceiling as well by this light as by the sun itself. The magnet affects this light; as I approach the end of the magnet to it you see a certain deflection of the arc. The conduction of this circuit is imperfect at the charcoal points: thence the heat and light, simultaneously with which phenomena particles of carbon are carried across the space between the points from one pole to the other through the air. It is a means of producing light which offers no permanency, since, from the continual wear of the charcoal points, our arrangement is in constant need of readjustment. The carbon points are rapidly undergoing decomposition through volatilization in the air, and unless we are constantly employed in attempting to keep up the right distances between them the light goes out. There is another way of obtaining light similar to the lime light I exhibited early in the evening, inasmuch as it depends upon the incandescence of a solid body. A metal is chosen not being a good conductor, and made to form part of a galvanic circuit. This is illustrated in the chain composed of alternate rings of silver and platinum; the silver is by far the better conductor, and as it offers no resistance to the passage of the current, but leads it, although it is not itself affected; but the platinum resists the passage and becomes incandescent, and is capable, under these circumstances, of evolving a most beautiful light. These are the two methods of obtaining electricity,—one by the incandescence or ignition of metals, which by this means we can support as long as the battery furnishes a supply of electricity; the other by an imperfect conductor interposed, which is speedily consumed. It is on these means of obtaining light that the patents which have been taken out, and which have contributed to some extent to popularize the subject, are founded. After a careful attention to the subject I am bound to say there is nothing new in them in a scientific point of view. The batteries are not new; the light exhibited is the same that has been shown before a hundred times within these last ten years. The difficulty which presented itself years ago presents itself still, viz., the impracticability, by any known means, of making those charcoal points permanent, or substituting others for them that they may come under ordinary management. Until this be done there can be no chance of a general application of this light for common purposes.

What is there new in the suggestions now introduced to the British public, with a view to working this light? In November, 1846, Mr. Staite took out a patent for certain improvements in lighting, consisting of a method or methods of maintaining uniform distances between the points. His arrangement, then, was to pass his charcoal points into two cylinders, into which they fitted and passed freely up and down. A spring of coiled wire was inserted so that as the point wore away the spiral spring pressed or was to press down the charcoal points, which were thereby kept constantly abutting on the little cylinder of gypsum or plaster of paris which received the ends of the charcoal points. This appeared a very simple arrangement for effecting uniformity of distance between two pieces of charcoal, and that was the only practical or important point that Mr. Staite mentioned in his patent of 1846; but in 1847, about eight months after his first patent was taken out, he took out a second, and I think it is fair to infer that as in his second patent he makes no mention of his previous mechanical arrangement, but passes it over in silence, suggesting new ones on new principles,—I think, I say, it is not unfair or unreasonable to suppose that his first did not answer the purpose; and I can readily conceive the reason. Charcoal is deposited from the positive to the negative pole, and there is, consequently, an accumulation of charcoal-dust about the electrodes, which are thereby clogged up and will not work. Thus this seemingly plain arrangement is compelled to give way to one altogether different. Mr. Staite's second patent was taken out in July, 1847, and introduces a new principle of mechanism, for the purpose of regulating the distance between the electrodes. In this arrangement he has a coil of wire wound round a hollow cylinder, and in the centre of the coil an iron bar which carries upon its top a rack and pin. This iron bar and rack are counterpoised by a weight passing over the other side, and the force of magnetism is applied to bring it down to force the electrodes into their proper position. When the electricity is laid on it passes through the coil, and the effect is that it converts the coil into a magnet, and thus the bar is drawn down and the electrode is brought to a certain proximity to the other electrode. This will go on till the distance becomes so great that contact will be broken. But this is only an interrupted light, suitable, says Mr. Staite, for signals on railways, for lighthouses, and similar purposes. We have still to look for the constant light. Then he has another arrangement for a constant and uniform light, the mechanism of which is too complicated for me to explain, especially at this late hour. In this arrangement the motion is communicated by clockwork. Of this plan, though no mechanician, I will say that, as far as I can comprehend the scheme, it must at least be insufficient to produce a uniform and steady light. There is no doubt that the difficulty with which inventors have to struggle must here be extreme. It is next to impossible to calculate on your batteries for the exact consumption or waste of just so much carbon per hour, and find thus a permanent rate at which the points should be approximated. Batteries are not always alike, and cannot be got to work with machine-like regularity. That difficulty not having been removed, I doubt whether the arrangement will be very useful. But, then, the patentee does not depend on mechanism alone; he has a lamp which gives as brilliant a light as the charcoal points. And here let it be observed that those patentees who favour us with their researches and discoveries have none of them exhibited the new light for more than a few minutes. I can make this burn by the half hour with very little trouble. But Mr. Staite proposes an electric light consisting of incandescent metal to be used in a lamp containing a coil of wire; and he calculates that by employing an extremely infusible metal he shall get a light for ordinary purposes. The metal he adopts is iridium. I understand a person is making lamps at the present time, and preparing metal for tha purpose. Whether there is sufficient of that metal at command is doubtful. With respect to the cost, I will quote the estimate of Mr. Grove. He experimented with a battery of fifty cells; it cost him seven shillings to charge it; and he calculated that to keep it going for one hour would cost in zinc and acid two shillings, and that, allowing for the wear and tear of apparatus, &c., it would cost three and sixpence to four shillings an hour.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE PREPARATION OF THE COMPOUND SYRUP OF CHICORY.

By M. H. BRETON, of Grenoble.

In the Codex formula of the compound syrup of chicory it is prescribed to pour the boiling syrup upon the bag containing the cinnamon and sandal.

This method is objectionable in this much, that the syrup, though boiling, is little adapted to dissolve the tonic and aromatic principles of these substances.

The following process answers the purpose much better:—

Pour a sufficient quantity of boiling water over the cinnamon and sandal, to cover these substances entirely. Let the mixture infuse for twelve hours; strain, add to the limpid liquid double its weight of white sugar, and make a syrup by simple solution.

Prepare, on the other hand, the compound syrup of chicory according to the formula of the Codex, simply diminishing the quantity of sugar syrup by an equal weight to that of the aromatic syrup. Mix the two products.

The syrup prepared according to this process is much more strongly aromatized than that of the Codex; and there can be no doubt but that its tonic properties also are proportionately increased.—*Journal de Pharm. et de Ch., Feb.*, 1849.

ALKALINITY OF CERTAIN FLUIDS OF THE HUMAN BODY IN CHOLERA.

By Dr. BURGUIÈRES.

This physician has recently, during the prevalence of the cholera at Smyrna, investigated the acid or alkaline reaction of the different animal fluids in cholera.

It will be recollected that Dr. Andral's researches on the reaction of the divers fluids of the human economy led that eminent physician to the conclusion that these fluids present, both in health and illness, a remarkable constancy of reaction.

It was interesting to know whether the law thus established by Professor Andral obtains equally in Asiatic cholera.

Dr. Burguières' researches on this subject gave the following results:—

The *blood* of patients suffering from an attack of cholera, or of those who had succumbed to it, proved constantly alkaline.

The cold and viscous *perspiration* which is exhaled during the period of cyanosis is invariably neutral. During the period of reaction it acquires acidity, which is, generally, a good sign.

Gastro-intestinal Liquids.—At the commencement of the attack the matters rejected by vomiting were found acid; after three or four vomitings they were found to have turned alkaline. The matters found in the stomach after death, and the mucous membrane of the organ, manifested equally an alkaline reaction.

The stools, and the matters found in the intestines after death, were equally alkaline.

To sum up briefly, in patients suffering from an attack of Asiatic cholera the normal acid reaction is suspended at the cutaneous surface, and replaced in the stomach by an alkaline reaction.

We have, then, in cholera a great perturbation in the equilibrium of the secretions—a perturbation which we do not meet with in any other disease.—*Gazette Médicale.*

ON THE PRODUCTS OF THE DISTILLATION OF BEESWAX.

By M. TH. POLECK.

In the distillation of beeswax a small quantity of an acid is produced, which is soluble in water. I have carefully examined this acid, which has hitherto been looked upon as acetic acid; the results of my researches have proved it to be a mixture of acetic and metacetic acids.

A more copious product of the distillation of wax is a solid fatty acid, which dissolves in hot alcohol of a moderate degree of concentration, and crystallizes from this alcoholic solution upon cooling. It fuses at 131 or 131.9 Fahrenheit, and its chemical composition agrees tolerably with that of margaric acid:—

$$C_{34}\ H_{34}\ O_4.$$

However, the results of the analysis of the free acid, which never produced the proportion of carbon demanded by the preceding formula, and more particularly the analyses of the ether and of some of the salts formed by it, make me inclined to look upon it as a mixture of palmitic and margaric acids. This subject requires, however, still further and more minute researches.—*Annalen der Chem. und Pharm.*, vol. lxvii., page 174.

CURE OF TETANUS BY INTOXICATION.

Tetanus is unquestionably the most formidable complication of the lesions to which carpenters, masons, bricklayers, mowers, sawyers, and other labourers are liable. This terrible affection kills one half at least of those whom it attacks, and its victims are mostly young and vigorous. A great many agents and curative methods have been tried, with less or greater success, to combat this affection; but not one of them has ever been found to answer equally in a number of cases. It would be highly desirable that a series of experiments and researches should be entered into with a view to determine in what respective species of the tetanic affection such or such a remedial agent might be considered efficacious. Meanwhile we will here point out another remedy, of a rather curious complexion, which has recently been used with success in several cases, viz., intoxication with spirituous liquors. We will briefly quote here one of the cases in which this novel remedy has been applied with perfect success:—

A little boy, five years of age, cut his finger: tetanus came on; the various methods recommended for the cure of this affection were resorted to in vain. One of the physicians gave at last the folowing prescription:—

Take of Generous white wine, 400 grammes.
Tincture of cinnamon, 15 grammes.
Syrup of gum, 90 grammes.

In the evening and up to midnight the child took two thirds of this potion. The consequences were: delirium, vomiting, diarrhœa, and, subsequently, abundant perspiration and profound sleep. The next morning the tetanic symptoms had disappeared, and there remained only a little cerebral congestion, which also vanished speedily.

The same successful results were subsequently obtained in several other cases.—*Annales Médico-Psychologiques.*

ON CANNABIN AND THE MODE OF ADMINISTERING IT.

By M. DORVAULT.

Cannabin is a product extracted from the haschich. Dr. Willemin, of Cairo, has employed it with success against the Asiatic cholera. It is amorphous, and looks brown in mass, greenish in thin layers. When it is heated upon

a platinum plate it liquefies, and burns without leaving the slightest residue behind. It has an aromatic and nauseous odour, and a peppery, acrid, and tenacious taste.

It is insoluble in water, soluble in alcohol, ether, fats, fixed and volatile oils.

I feel inclined to give cannabin the preference over all other preparations of the cannabis indica, on account of the fixed and invariable proportion of the active principles which it encloses. The great point for the practitioner is to ascertain what adjuvants and excipients are most proper to ensure its most vigorous action upon the organism; for it appears clearly demonstrated that certain substances, coffee for instance, lighten the effects of the haschich.

Cannabin is most readily administered in form of pills, pastiles, or alcoholate. M. Willemin used the latter form, in conjunction with an infusion of tea or camomile.

The following formula gives an excellent product:—

Take of Cannabin, 1 gramme.
Alcohol of 90 Cent., 9 grammes.

Dissolve the cannabin in the alcohol, let the solution stand for a few hours, and filter.

One gramme of this tincture contains one decigramme of cannabin, which is the dose given by Dr. Willemin.

I prefer the pilular form, more particularly as the tincture, when mixed with ptisan, produces a precipitate in the latter. In cases of cholera, however, where patients can only swallow liquids, the tincture must, of course, be preferred to the pills.—*Bulletin de Thérap.*

IMPURITY OF BROMINE OF COMMERCE.

By M. POSELGER.

During the distillation of certain samples of bromine of commerce I observed that the boiling point of the liquid stood at 478.4 instead of 251.6 Fahr., and that the liquid acquired a lighter and lighter colour, and became in the end perfectly colourless. I carried the distillation to dryness, and found a residue of charcoal.

In separating the bromine from the last portion of the distilled liquid, by means of a solution of potass, an oily, aromatic, colourless liquid was obtained, which upon analysis turned out to be bromide of carbon.

This admixture of bromide of carbon was found in divers samples of bromine of commerce to the extent of six to eight per cent. of the article.

It is most probable that the bromide of carbon owes its origin here to the ether used for the preparation of the bromine. — *Poggendorf's Annalen.*

ON THE ADULTERATION OF OPIUM WITH EXTRACT OF GLAUCIUM.

By M. LANDERER, of Athens.

The Glaucium luteum and the Glaucium rubrum, annual plants belonging to the family of the Papaveraceæ, are very common in the environs of Athens. An herbalist of that city, mistaking these plants for poppies, made an extract of them, partly by incisions in the stem, and partly by the decoction of the fresh plant. He offered this for sale as opium to several apothecaries, and among others to M. Landerer, who detected the fraud. This extract of glaucium exhaled a narcotic odour, and had a very bitter taste, similar to that of opium; in short, the article bore the greatest resemblance to the inferior sorts of Smyrna opium.

M. Landerer thinks this is a subject worthy of attention, as he has since learnt from several highly-respectable inhabitants of Smyrna that the manufacturers of opium in that town make an extensive use of these two species of glaucium, and more particularly of the red glaucium (G. rubrum Phœniceum), which latter greatly resembles in external appearance the Papaver rhœas. In fact, it would appear that nearly the whole of the opium sold at Smyrna is simply an extract of these plants, and the theriac which is sold at the bazaars is mostly, or almost exclusively, prepared with this extract. — *Büchner's Repertorium.*

ORIGIN OF SUGAR IN THE ANIMAL ECONOMY.

By MM. CL. BERNARD and BARRESNIL.

The researches which these gentlemen have undertaken on the origin of sugar in the animal economy have led to the following conclusions:—

1. In the physiological state there exists constantly sugar of diabetes in the blood of the heart and in the liver of man and the animals.
2. This sugar is formed in the liver, and its formation is altogether independent of a saccharine or amylaceous alimentation.
3. The formation of sugar in the liver commences before the animal is born, and, consequently, before the ingestion of food.
4. This production of saccharine matter, which would accordingly appear one of the functions of the liver, seems dependent upon the integrity of the pneumogastric nerves.

This unexpected discovery cannot fail to exercise the greatest influence upon the prevailing theories on diabetes.—*Mém. de l'Acad. des Sciences*, 1848.

ANALYSIS OF THE WATER AND MUD OF THE SERPENTINE IN HYDE PARK.

The attention of the public has recently been directed to the impure state of the water forming the lake, or so-called river Serpentine, in Hyde-park. This large body of water, to which hundreds of men and boys daily resort throughout the summer months to cool their feverish skins, has, for several years past, been allowed to become a stagnant pond. The loss by evaporation from so large a surface of water has been supplied partly by springs in the bed of the river, and partly by the contents of certain sewers which have been made to empty themselves here, to refresh, with their exhalations, the crowd of smoke-dried citizens who throng the fashionable promenades and drives which surround it. The following analyses of the water and mud of the Serpentine were made by Mr. Thomas Savory, in the laboratory of the Pharmaceutical Society, at the request of Dr. Tilt, who has taken an active part in the measures which have been adopted in reference to this public nuisance. The character of the water will be best appreciated by comparing the analysis with that of the waters of other rivers.

Examination of the Water and Mud of the Serpentine.

Three specimens of the water were obtained, from different parts of the river, in the month of December, and after continued rains. The imperial gallon, or 70,000 grains of each specimen, carefully evaporated to dryness, afforded of solid residue, dried at 300° Fahr., as follows:—

No. 1	22.30 grains.
No. 2	25.35 "
No. 3	27.00 "

In each case the water, when much concentrated, assumed a thick, greenish-yellow appearance, and emitted an offensive smell. The smell of one of the specimens resembled that of a cesspool. The solid residue in each case was of a greenish-yellow colour. The specimen No. 1 was submitted to analysis, and yielded—

Substances found.	Grains in Imperial gallon.
Silica	.590000
Carbonate of lime	.603128
" " magnesia	.709279
" " soda	6.045783
Chloride of sodium	5.180700
Sulphate of soda	2.097250
Phosphates of lime and iron..	2.100000
Organic matter	4.973860
	22.300000

A specimen of the mud taken from one of the banks of the river was dried by the heat of a water-bath, and submitted to analysis. It was found to contain—

	Grains.
Insoluble silicates	75.20
Carbonate of lime	2.02
Peroxide of iron	7.89
Sulphate of soda	2.08
" " lime	2.06
Alumina	a trace
Organic matter, containing ·44 of sulphur, and ·742 of nitrogen, equivalent to ·902 of ammonia..	9.25
	98.50

In the decomposition which the organic matter would undergo, in contact with atmospheric air and water, the sulphur above indicated would be converted into sulphuretted hydrogen and other volatile sulphur compounds, and the nitrogen into ammonia, forming, at times, hydrosulphuret of ammonia, the product of privies and cesspools. — *Pharmaceutical Journal.*

RECTIFICATION OF THE SPIRIT OF NITROUS ETHER.

By M. KLAUER, of Mulhouse.

When alcoholized nitric ether has turned acid, it is usual to rectify it by distillation over calcined magnesia. This process does not prevent the rectified product turning acid again at the end of a few weeks. I have found that the sweet spirit of nitre may be freed from all further tendency to turn acid by rectifying it over neutral tartrate of potass instead of over magnesia. After this rectification it will keep for months without betraying the slightest sign of acidity.—*Medicinische Zeitung.*

THE CHEMICAL TIMES.

SATURDAY, MARCH 17, 1849.

THE GAS COMPANIES AND THE GAS CONSUMERS.

The companies which at present supply the city of London with gas do not seem inclined to relinquish even a comparatively trifling portion of the heavy tax which they have hitherto levied, and still continue to levy, upon the inhabitants of the City. From the report of the committee of the projected Gas Consumers' Company, which was read before a most numerously and respectably attended meeting, held on the 14th inst., at the London Tavern, it appears that one of the two companies which supply the City, and to which application had been made to reduce the price of their gas, refuses to give an answer for the present, and the other desires the applicants to wait for the reply which will be given on the 13th of April to the commissioners of sewers upon the same subject. If, as is but too evident, these refusals and delays are prompted by a desire to gain time, and to defer the dreaded reduction as long as can possibly be managed, they have in this instance singularly failed to effect the purpose which they were intended to accomplish; for, instead of consenting (as had probably been expected) to wait until it might please the two companies to come to a decision and to give a categorical answer on the subject, the gas consumers, to whom these curt and unsatisfactory replies were communicated, resolved to enter without further delay, and vigorously, upon the execution of the project of starting a com-

pany of their own. Should the inhabitants of the City (and there can hardly a doubt be entertained but that they will) carry their resolution into effect, we cannot well see how the companies which have hitherto enjoyed the gas monopoly will be able to maintain, not their present position, but any position at all, unless, indeed, they offer to reduce the price of their gas even below that of the new company—which is not very likely. The projected new company offers to supply its consumers with gas at a maximum price of 4s. per 1,000 cubic feet, and promises to charge only 3s. per 1,000 cubic feet, if possible. Now, low though these prices seem, there can be no doubt but they might be still further reduced. Mr. Boville, indeed, promises to supply the consumer at a cost of 3d. per 1,000 cubic feet; and, although we are of opinion that that gentleman somewhat exaggerates the facilities and overlooks the difficulties of his plan, and the obstacles which he may have to encounter in its practical execution, yet we do not look upon the scheme as altogether chimerical. We think it feasible, though, perhaps, not just at the present time.

But, even assuming Mr. Boville's plan to be altogether impracticable, we maintain that gas of very superior quality may be produced and sold at from 1s. 6d. to 2s. per 1,000 cubic feet, making due allowance for a reasonable interest on the capital employed, and a fair profit besides.

The Gas Consumers' Company will find this to be a fact, provided, of course, they put the management of the works into the hands of a good practical chemist, who will not allow any of the products to go to waste, but will turn everything to a profitable account. Under good and strict management, and with a fair number of customers, the supplying of gas of the very best quality at the low price of 1s. 6d. per 1,000 cubic feet would probably still turn out one of the most lucrative investments for the capitalist to make. And, besides, may we not reasonably expect that the introduction of gutta percha, that article of truly Protean application, and which is so eminently adapted for the construction or the covering and lining of tubes and pipes of every description, will tend to considerably reduce one of the most important items of the first and most indispensable outlay required for the erection of the works, laying down of the pipes, &c. &c. ?

Under these circumstances we urge the committee of the projected Gas Consumers' Company most strongly to reject all and every compromise which the existing companies might *now* feel inclined to offer, and not to allow themselves to be deterred from their present purpose by any consideration whatsoever—unless, indeed, the existing companies should offer to supply their customers henceforth with the best gas at as low a cost as the projected new company can reasonably expect to produce it at, with every allowance for interest on the capital invested, and a fair profit.

James Baird, of Gartsherrie, in the parish of Old Monkland, in the county of Lanark, in Scotland, iron-master, and Alexander Whitelaw, of the same place, manager, for improvements in the method or process of manufacturing iron. Patent dated March 7th, 1849; six months.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for an invention of an improvement or improvements in making coupling-joints for pipes, nozzles, stop-cocks, still and cylinder heads, and other apparatus. Patent dated March 22d, 1848. Enrolled September 20th, 1848. (Communicated to the *Patent Journal.*)

This invention relates to an improved means of connecting together tubes or pipes for the conveyance of water, steam, gas, or other fluids or liquids, and it is also applicable to fastening on the ends of steam or other cylinders or vessels, securing still-heads, connecting shafts together, and to nearly every purpose where parts of various kinds of apparatus require to be connected together by bolts or screws passed through flanges.

The specification is accompanied by engravings showing the manner in which the fastening, called by the inventor the "clasp coupling-joint," is applied to the coupling of pipes, &c. &c.

The principle or character of the invention consists in forcing together the two bodies to be coupled or connected, by means of a grooved segmental or other clamp, according to the form of the parts of the vessel or article to be coupled. The groove of the coupling embraces the flanges or their equivalents, which project from, or are connected with, the bodies to be coupled; so that when the said grooved segments are drawn together by screw-bolts, keys, conical wedge-rings, or any other appliance of the kind, the groove therein shall act on the said flanges or their equivalents, so as to force them together, and thus make a tight joint, with or without interposed packing.

In the coupling of pipes the sections to be joined are provided each with a turned or upset flange; packing is usually interposed; this may, however, be dispensed with by facing the flanges, or making what is termed a ground joint. At the junction of the two pipes a pipe of small diameter is introduced to serve as a guide in joining the flanges together; but this may be dispensed with if desired. Over the two sections of the pipe, and extending over the flanges, are two rings, one for each section, the inner faces of which correspond, or nearly so, with the faces of the two flanges, and are curved or bevilled on their outer faces. These rings should be made to fit somewhat closely on to the sections of the pipe, or they may be shrunk on if desired. When the two flanges and rings are put together, face to face, they are embraced by a segmental clamp, made in two parts, the inner periphery of which is grooved to embrace the rings, and to act on their outer curved or bevilled faces, so that when the said segments are drawn together, by means of screw-bolts passing through ears which project from their ends, the sides of the grooves are made to act in a wedge-like manner on the outer curved or bevilled faces of the rings, to force them and the flanges of the sections of the pipe together, and there hold them firmly. In this way it will be seen that the flanges are forced and held together around the entire circumference simply by the use of two bolts; thus effecting a better joint, which can be connected and disconnected in less time, and held with more strength, than by the means heretofore employed.

The segments of the clamp may be forced together also by means of a conical ring.

Instead of the clamps, screw-bolts, or conical rings, keys, or other modes of drawing or forcing together the segments of the grooved clamp, may be substituted. The rings that extend over the flanges may be dispensed with, and the grooved, segmental, or other clamp may be made to act directly on the flanges; but it is better to use the rings, as they can be more readily adapted to the groove of the segmental clamp, and at the same time give strength and support to the flanges, which in general are formed by turning over and upsetting the metal of the pipe. If desired, packing of any kind may be interposed between the flanges and the rings; but this in general will not be found necessary. Care should be taken to leave the groove in the segmental clamp of greater depth than the projection of the flanges and rings, in order to give ample room for drawing together the segments; care should be taken also to have the curve or bevil of the outer face of the rings, or of the flanges (in cases when the use of the rings is dispensed with), of greater or less curve or bevil than the groove of the segmental clamp, so that in forcing them together the segments of the groove may act in the manner of a double wedge. The curve or bevil of the groove should be made more acute than the faces of the rings or flanges, so that in wedging them on the sides of the grooves may act on the rings or flanges nearer to the periphery of the pipe than would be the case if this state of things were reversed.

The improved coupling is equally applicable to the coupling of the parts of angular articles. It may be resorted to, for instance, to secure the cap on to a quadangular vessel. For this purpose the upper edge of the vessel is provided with a projecting flange, with the under face rounded or bevilled, and the upper edge of the cap-plate is similarly rounded or bevilled to correspond therewith; these, when put together, either with a close fitting (ground) joint, or with packing interposed, receive the grooved clamp, which is made in four parts, each part fitted to one of the angles of the vessel. These four sections, which are provided with projecting ears, are then drawn together by means of a screw-bolt, and thus couple and bind together the vessel and its cap, making a tight joint all round. Instead of uniting the sections at the four faces of the square, they may be united at the angles.

In coupling angular vessels, or other articles of angular shape, it will be found to be advantageous to make the grooved clamp in as many sections as there are sides to the figure; for round couplings it will be found sufficient to make it in two parts for all articles of moderate size; but when the diameter is very considerable it may be divided into three or more parts. This improved mode of coupling is equally applicable to the securing of nozzles, stopcocks, or many other articles not necessary to enumerate, but more particularly to cylinder-heads, in which latter the edge of the head takes the place of one of the flanges.

Shafts and other solid bodies may, of course, be coupled together in the same manner as hollow conduits or vessels, and with equal advantage. The flanges, instead of being solid projections of the bodies to be united, may be made separate, and connected therewith in any manner desired, as the mode of making the flanges forms no part of the invention.

The leading advantages of this mode of coupling over the ordinary double flange and bolts heretofore, and now generally used, are stated to be a great reduction in the number of screw-bolts used, which occupy much time in connecting and disconnecting joints, particularly in the parts of steam-engines, such as the cylinder-heads, and other parts which require to be frequently connected and disconnected for packing and other purposes; also increased strength, and more perfect and continuous support, as the flanges, by the improved plan, instead of being reduced in strength by the numerous bolt-holes, are pressed together, and supported all round by the grooved segmental clamp; moreover, the strain on the threads of the screw-bolts, instead of being in the line of the force which tends to separate the coupling, as in the old plan, is nearly at a right angle therewith, and, therefore, greatly relieved.

The patentee claims the coupling of joints by means of flanges, or their equivalents, in combination with a grooved clamp, the groove of which is formed to embrace the flanges; and

which clamp, when drawn or forced together by screw-bolts or other equivalent means, will force and hold together the flanges of the parts to be connected, and thereby form a firm and secure joint.

Edward Thomas Truman, of the Haymarket, London, dentist, for an improved method or methods of constructing and fixing artificial teeth and gums, and of supplying deficiencies in the mouth. Patent dated August 15th, 1848. Enrolled February 15th, 1849.

This specification relates to the manufacture of artificial gums. It consists of two parts, the preparing and forming artificial gums by means of gutta percha. The mode adopted by the patentee is to procure a cast of the mouth in plaster, in the usual manner; a frame (of gold or platinum) is then formed, and small vertical pins are secured to it, upon which the artificial teeth are placed. Pure gutta percha, made plastic by heat, is now moulded upon the frame by the fingers, and then pressed upon the plaster cast, which has previously been moistened with cold water. The gutta percha cast may afterwards be again heated, and then pressed into the mouth, by which means it will be made to adapt itself most accurately to the irregularities of the mouth. The artificial teeth are now removed from the pins, and the gutta percha is then electrotyped over the whole of its surface, with the exception of the part coming in contact with the gums. The teeth are now secured upon the pins in the gutta percha sockets by means of cement, in the usual manner. The patentee states that, although means may be adopted for fixing these artificial teeth and gums in the mouth, yet he has hitherto invariably found them unnecessary, the mere fitting of them to the gums being sufficient.

The second part of the specification relates to the manufacture of artificial gums of hard wax, or other plastic substances, which, after being properly fitted to the mouth, are electrotyped over the surface. The metallic covering serves to strengthen the artificial gums, and to protect the material of which they are made from the action of moisture.

The patentee claims:—

First. The manufacturing artificial gums of gutta percha, and coating the surfaces thereof with metal.

Secondly. The application of electro-gilding to the manufacture of artificial gums made of soft material.

William Young, plumber, and Henry Burgess Young, both of Barnstaple, in the county of Devon, for improvements in smelting and refining lead ores. Patent dated August 28th, 1848. Enrolled February 28th, 1849.

This invention relates to a method of obtaining and saving the minute particles of oxides, &c., which, as the process is conducted at present, are carried off along with the products of combustion from the various lead smelting and refining furnaces. The patentee proposes to attain the end in view by the following arrangement:—The flue from the ordinary smelting or refining furnace is conducted in a horizontal direction to a large chamber or tank, placed at some distance from the furnace. The bottom of this tank is covered with water, into which the end of the flue is made to dip to the extent of a few inches. The immersed end of the flue is secured to the centre of a perforated metallic plate, about three inches less in size than the interior of the tank; a rim runs round the edge of the plate, and projects downward a few inches; a similar rim runs about midway between the outer rim and the centre of the plate. The lower parts of these rims are perforated. At any convenient part of the horizontal flue between the furnace and the tank or chamber is placed a blower or exhausting-fan drawing the atmospheric air through the furnace and the flue, and discharging it into the tank below the surface of the water, and beneath the perforated plate. The heated air and products of combustion thus drawn through the flue carry along with them a quantity of fine particles of oxide and other matters; the whole of this is discharged from the end of the flue beneath the perforated plate, and thus forced through the perforations, by which means a considerable portion of the solid particles is deposited in the tank. The vapours and products of combustion are then made to pass successively through several low-vaulted chambers, with finely-perforated metallic plates placed within them. The solid particles are thus retained in these chambers. From the last of these chambers the air and the gaseous products are conveyed by a flue to the ash-pit of the smelting or refining furnace, where they mix with the atmospheric air which passes into the furnace.

The patentee claims the general arrangement of the apparatus, and the principle and mode of the operation.

Thomas Richardson, of Newcastle-upon-Tyne, chemist, for improvements in the condensation of metallic fumes, and in the manufacture of white lead. Patent dated August 21st, 1848. Enrolled February 21st, 1849.

This specification describes:—

First. The mode of treating tea lead with a current of hot air, for the purpose of extracting from it the tin and other extraneous matters mixed with it. The process consists in exposing the tea lead, while in a state of fusion, in the ordinary red-lead chamber, or in a suitable cast-iron pan, to a slow current of heated air, which has the effect of separating the tin, which then floats upon the surface of the melted lead, from whence it is removed by the workman from time to time. When the lead has been operated upon sufficiently long to extract the whole of the tin, it is then to be removed by running it out, or by other convenient means, and cast into moulds. The workman can with facility tell when the lead has been sufficiently operated upon by its being, when cold, easily scratched with the finger nail. The tin obtained in this process contains a small admixture of oxide of lead. The purified tea lead is now brought to a state of minute division, either by crystallization by Mr. Pattinson's process, or granulation by the ordinary method. In this state it is operated upon either with acetic or nitric acid, or a mixture of both, diluted in either case with an equal weight of water; or with a solution of acetate or nitrate of lead, or a mixture of both, containing an equal quantity of acids as the preceding; these acids or saline solutions are applied in conjunction with steam, hot air, and carbonic acid gas. The apparatus employed by the patentee for conducting this process consists of a strong suitable framework or building of wood, masonry, or other proper materials, in which a number of shelves are arranged, which are covered with sheet lead; the shelves are heated by steam or hot air. The metallic lead to be converted into white lead is, in its granulated or divided metallic state, spread out upon the shelves, and there submitted to the action of carbonic acid, which is admitted to the space between the shelves by suitable pipes; other pipes convey steam or hot air for maintaining the apparatus during the process at a high temperature. Steam is occasionally admitted to the lead during the operation, for the purpose of keeping it in a proper state of moisture. At the expiration of from twelve to fourteen days the lead will be found sufficiently converted, when it is to be removed to the dolly-tub, where the metallic lead which has not been converted is separated, and returned back to the shelves with a fresh charge of lead.

The third part of the specification is the condensation of metallic fumes, which are carried into a tower near a chimney about twenty feet high, and divided vertically by a partition into two compartments. The metallic fumes, which have previously been mixed with steam in jets, pass up one of the compartments, and down the other into the chimney. In the downward compartment a number of iron bars are placed in a horizontal position; upon these are placed a quantity of coke or broken bricks, on which water is made to drop, to keep them moist. The fumes pass through this mass in its passage through the tower to the chimney, and are thus condensed. Should the draught of the chimney not be sufficient to cause the fumes to pass through the tower, means are to be adopted to render it so.

The patentee claims:—

First. The separation from tea lead of the tin and other extraneous matters combined with it, by oxidizing the tin by means of a slow current of hot air, as described.

Secondly. The conversion of metallic into white lead by the action of carbonic acid used in conjunction with steam and heated air, and either with acetic or nitric acid, or a mixture of the two latter, or with acetate or nitrate of lead, as described.

Thirdly. The application of steam, used in conjunction with a shower of water, and with or without a steam jet, for the purpose of condensing metallic fumes, as described.

John Lewis Ricardo, Esq., M.P., of Lowndes-square, in the county of Middlesex, for improvements in electric telegraphs, and in apparatus connected therewith. Patent dated September 4th, 1848. Enrolled March 4th, 1849.

This invention relates, first, to the insulation of the wires used for electric telegraphs by enclosing two or more wires between two fillets of gutta percha or an appropriate mixture of the latter substance with other materials. Secondly, to an apparatus for suspending the wires used in electric telegraphs in a manner to render them inaccessible to wet or damp.

The patentee does not claim the use of gutta percha, or of any mixture of that substance with other materials, to effect the insulation of electric telegraph wires, as he is perfectly aware that gutta percha has already been extensively used for that purpose. He claims simply the mode of applying the gutta percha. He uses either the pure gutta percha, or a mixture of eight parts of that substance with one part of gum cowrie, and one part of flowers of milk of sulphur. He moulds the gutta percha or the mixture in fillets of the proper width to enclose the number of wires required, and also to form a blank bead on each side of the wires, for the more effectual protection of the edges. The wires, as they are being covered, are passed through a guide-plate, in order to keep them at regular distances apart; from this they are passed between two rollers heated by steam, having grooves on their circumference, the ridges between which form indentations on each side of the gutta percha between each wire, but to a sufficient extent only to cause the two fillets to adhere and become incorporated with each other, so as to effect the perfect insulation of each wire from the adjoining ones. The rollers at the extreme grooves are in contact, and produce a blank bead on each edge. The gutta percha is reduced to an adhesive state by the heated rollers, and in order to ensure the perfect adhesion of the surfaces of the fillets they are passed over and under heating surfaces during their passage to the rollers, care being taken to support the lower fillet, which will have to be passed under the heating surface, so that its upper surface may be rendered plastic, in order to prevent its elongation while in that state. The insulated wires are wound up on a reel by means of a weight sufficient to remove it as fast as delivered by the rollers. In covering wires with gutta percha it has been usual to enclose each wire separately in a cylinder of that material; while in this new plan two or more wires are enclosed together between two surfaces of gutta percha, or of a mixture of the latter substance with some other material.

The apparatus which constitutes the second part of the invention consists of a common support, such as is used at present for the purpose, having an eye or hook suspended to the centre by a nut in the recess at the top, which is afterwards filled up with cement. The cylindrical

projection-part of the support has a groove or throat cut round it, by which means any water coming in contact with the outer surface is intercepted, preventing thus its getting access to the point of suspension; and it is this throat or groove that constitutes the novel feature in this, the second part of the invention.

The patentee does not confine himself to the detail given. He claims :—

First. The mode of combining two or more wires for electric telegraph purposes by enclosing them between two fillets of gutta percha, or some appropriate mixture of that substance with other materials, in such a manner as to insulate the wires from each other, and from external matters.

Secondly. The construction of the apparatus described for suspending wires for electric telegraphs.

Alexander Angus Croll, of the Gasworks, Tottenham, for improvements in the manufacture of gas, and in apparatus to be used in transmitting gas. Patent dated August 22d, 1848. Enrolled February 22d, 1849.

The improvements in the manufacture and the distribution of gas described in this specification consist :—

First. In the construction of the retorts in the furnace, and in the mode of charging them simultaneously at both ends.

Secondly. In the employment of steam, which is passed through carbon in a highly-heated state, and then mixed with the gas generated from the charge of coal.

Thirdly. In the purification of coal-gas by means of sulphurous acid.

Fourthly. In the arrangement and construction of the apparatus employed for delivering the gas from the gasworks to the gasholder.

Retorts have hitherto been used with openings at both ends, and which are closed by proper covers, and so arranged in the furnace that they can be charged with the coal from each end. They are also provided with an upright pipe, for the purpose of conveying the gas generated in the retort from the latter to the gasmain. The mode of working with these retorts is to charge at each end alternately at regular intervals of time, one half of the retort being charged at a time; thus, the gas generated from the last charge is made to pass over the previous charge, which is comparatively exhausted, the upright pipe at the end of the most recent charge being closed while the other remains open; thus do the opening and the closing of the upright pipes take place alternately with the times of charging from each end respectively, so as to ensure the satisfactory working of the retort.

The patentee's improvement consists in the use of retorts in the manner just now described, but having only one upright pipe. The mode of working these retorts is to charge them from both ends simultaneously; the patentee states that this mode of constructing and charging is productive of superior gas.

The second improvement is the employment of steam, mixing with the gas generated. This the patentee effects in the following manner :—The steam is passed through carbon in a highly heated state, previous to mixing with the coal-gas. He prefers the use, for this purpose, of the above-named description of retorts; namely, those capable of being charged at both ends. Into one end of the retort is placed a charge of coke; steam is conveyed into this end of the retort when the coke is at a red heat; passing through the latter, this steam mixes intimately with the gas generated from the coal, and the mixture of steam and gas passes then off through the upright pipe to the gasmain. The charges of coal into the retort, the patentee states, are to take place about every five hours. The steam is admitted into the retort only for about the first three of the five hours, the quantity of steam admitted varying according to the quality of the coals. The patentee uses about fifteen gallons of water, evaporated into steam, to one ton of Newcastle and bituminous coals; but when cannel coal is used somewhat more steam is required to produce a gas of fair illuminating quality.

The third improvement is the employment of sulphurous acid for the purpose of purifying coal-gas. The mode of proceeding is as follows :—A solution of sulphurous acid in water is prepared by burning sulphur in a stove or oven, and passing the fumes into water in a proper apparatus, similar to that of Woolfe, until the water is nearly saturated. The patentee states the proportion to be about six ounces of burned sulphur to each gallon of water. The almost-saturated solution is then poured into the first of a series of vessels, arranged and constructed similar to the ordinary lime purifiers of the gas-works; the second and third vessels are filled with weaker solutions of the same kind. Through these solutions the gas to be purified is transmitted, passing through the strongest solution first. In passing through these solutions the sulphur in the latter and the sulphur in the gas are both decomposed and deposited at, or precipitated to, the bottom of the vessels in the shape of flowers of sulphur. The spent solution is discharged in any convenient manner, and the sulphur collected and dried; the apparatus is then recharged with fresh solution. The patentee proposes the use of two of these apparatus, so that the gas may be passed through one whilst the other is being recharged. Should further purification of the gas be deemed necessary, it may subsequently be passed through washers (plain water purifiers) which are made to communicate with one or other of the sulphurous acid gas solution purifiers, according as the gas happens to be passing through the one or the other. To remove all traces of the sulphur, the gas is finally passed through the ordinary dry lime purifiers. The state of the purity of the gas may, at any period of the process, be ascertained by the usual test of acetate of lead for sulphuretted hydrogen, the smell indicating if there is the smallest proportion of sulphur present in the gas.

The fourth improvement relates to the means of passing the gas from the gasworks to the gasholders. The patentee proposes to place the gasholders at a distance from the gasworks near to the district which it is intended to supply, and the exhausting apparatus for discharging the gas from the main leading from the works into the gasholders near the latter. This apparatus has hitherto—where the gasholders have been placed at a distance from the works—been placed near the works, and has thus discharged the gas into the main leading to the gasholders. By the arrangement of the patentee the pressure of the gas in the main leading from the gasworks would be too low for the necessary supply of gas to the intervening district. To remedy this, and to maintain a constant and sufficient supply in the main, the patentee adopts the following means :—A return-pipe is so placed as to form a connection between the gasholders and the gasmain from the works. Before the exhausting apparatus, at a convenient part of this pipe, is placed a governor, which, whenever there is a tendency of the pressure of gas within the main, being reduced by the action of the exhausting apparatus, allows the passage of gas from the gasholder back to the gasmain, passing it in such quantities as to maintain the pressure in the main nearly equal at all times, and sufficient to supply the intervening district.

The patentee claims :—

First. The mode of charging gas retorts simultaneously at each end, as described.

Secondly. The employment of steam by passing it through highly-heated carbon, and afterwards mixing it with the coal-gas, as described.

Thirdly. The purification of coal-gas by means of sulphurous acid, as described.

Fourthly. The arranging and constructing apparatus for passing the gas from the works to the gasholders, and maintaining a constant pressure in the main, as described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MARCH 7TH, 1849.

Edward Westhead, of Manchester, manufacturer, for certain improvements in the manufacture of waddings. Patent dated March 3d, 1849; six months.

Henry Constantine Jennings, of Abbey-street, Bermondsey, practical chemist, for improvements in the manufacture of vehicles for mixing pigments, and also in the manufacture of white lead. Patent dated March 5th, 1849; six months.

Nathan Defries, of Grafton-street, Fitzroy-square, civil engineer, and George Brooks Pettit, of Brook-street, New-road, in the county of Middlesex, gasfitter, for improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings; also improvements in gas fittings, and in apparatus for controlling the passage of gas. Patent dated March 5th, 1849; six months.

Samuel Banks, of West Leigh, in the county of Lancaster, miller, for certain improvements in mills for grinding wheat and other grain. Patent dated March 5th, 1849; six months.

William Henry Green, of Basinghall-street, in the city of London, gentleman, for improvements in the preparation of fuel. Patent dated March 5th, 1849; six months.

PATENTS RECENTLY EXPIRED.

T. F. Bergin, Dublin, gentleman, for improvements in railway carriages, which improvements are applicable to other purposes. Patent dated March 4th, 1835; expired March 4th, 1849.

J. Prince, London, agent for an improved mould and apparatus to be used in making paper. Patent dated March 4th, 1835; expired March 4th, 1849.

J. J. Sheridan, Walworth, chemist, for certain improvements in the several processes of saccharine, vinous, and acetous fermentations. Patent dated March 9th, 1835; expired March 9th, 1849.

THE CHOLERA.

	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
Cases already reported :—				
In London and vicinity...	1176	606	136	434
In the country	1023	446	165	412
In Scotland	11873	5159	4130	2584
Total	14072	6211	4431	3430

Fresh cases reported on the 14th of March, 1849 :—In London and vicinity, viz. :—Whitechapel—number of cases, 4; death, 1.

In the country, viz. :—Liverpool—number of case, 7; deaths, 3.

In Scotland, viz. :—Edinburgh—number of cases, 1; recoveries, 3. Glasgow (11th)—number of cases, 6; recoveries, 6; ditto (12th), number of cases, 2. Kilburnie—number of cases, 2; recoveries, 2. Riccarton—number of cases, 5; death, 1; recoveries, 9. Greenock—number of cases, 3; deaths, 4; recovery, 1.

Total new cases, 30; deaths, 9; recoveries, 21.

BIRTHS AND DEATHS IN LONDON.

The statement of births and deaths in London, during the week ending Saturday last, published by authority of the Registrar-General, shows the number of deaths, from all causes, to be 1,047, being 122 below the weekly average for the last five years, ending December, 1848. An improvement has occurred in the mortality from epidemics, the number of deaths in the last week from epidemics being 243, which is little

above the average. Smallpox prevails much; measles is unusually low. Scarlatina and hooping-cough show a decrease on the previous weeks. Typhus has fallen to the average, viz., 42 deaths. The deaths from cholera are 15, and are thus specified in the report:—

KENSINGTON; St. Paul's, Hammersmith.—M. 6, "cholera (6 days)."

CHELSEA; South.—M. 68, "cholera morbus (30 hours);" F. 66, "diarrhœa (11 hours); cholera morbus (20 hours)."

WESTMINSTER; St. Margaret's.—In the House of Correction, M. prisoner, 31, "Asiatic cholera (38 hours), accelerated by want of common necessaries of life, prior to his reception into the prison," inquest,

BETHNAL-GREEN; The Green.—The two following cases occurred in Messrs. Warburton's Lunatic Asylum:—F. 75, "mania, cholera (3 days);" F. 65, "mania, consecutive fever after cholera."

ST. GEORGE'S-IN-THE-EAST; St. John's.—The five following cases occurred in St. George's Workhouse:—Mariner, 64, "cholera;" mariner, 69, "cholera (24 hours);" currier, 73, "cholera;" gunmaker, 77, "cholera;" wife of a gardener, 80, "cholera."

STEPNEY; Limehouse.—M. 49, "natural death, sudden, from Asiatic cholera," inquest.

ST. OLAVE'S; St. Olave.—In St. Thomas's Hospital, an American sailor, brought from the city of London, 30, "cholera (24 hours)."

BERMONDSEY; Leather Market.—F. 53, "cholera (2 days)." The medical man states that "deceased was of very intemperate habits, which doubtless predisposed her to take the disease."

ST. GEORGE'S, SOUTHWARK; Kent-road.—At 2, Crown-yard, son of a carman, 2, "Asiatic cholera (3 days)."

The number of births during the same week is registered at 1,544.

CHEAP GAS.—On Wednesday, the 14th inst., a meeting of more than 1,000 of the inhabitants of the city of London (gas-consumers) was held at the London Tavern, Bishopsgate-street, for the purpose of receiving the report of the committee appointed to confer with the gas companies with a view to their reducing the price of their gas. Mr. J. Dillon took the chair. The report of the committee stated that a deputation of their body had waited upon the Chartered Gas Company, and the City and Commercial Gas Company, stating the expression of opinion of the meeting of the 21st of February,—that the price of gas ought to be reduced, and requesting to hear their decision on the matter. The deputation having withdrawn, an intimation was conveyed to the committee that answers would be given in a few days. Accordingly a letter was received from the City of London Company stating that they had to give an answer to the commissioners of sewers on the same subject, on the 13th of April, and until that period they could not enter into any arrangement with individual consumers. The Chartered Company wrote to state that they could give no answer to the questions put by the deputation at present. The chairman then briefly addressed the meeting, stating that they had now only to determine what course to pursue in order to get their gas cheaper. Mr. Boville then addressed the meeting, stating that he had instituted experiments with a view of supplying London with gas manufactured on the coal field. By such a process the gas would not only be of a better quality, but, estimating the whole consumption of London, it could be put into their gasometer in the city at a cost of 3d. per 1,000 cubic feet—(Cheers and laughter). If the gas were used by only half of London, of course the cost would be 6d. He proposed to force the gas through the mains by atmospheric pressure. He had made the proposition to the City of London Company, and offered to supply them at 1s. per 1,000 cubic feet. They at once admitted that the plan was an excellent one, but, after some communication had taken place, so many interests were opposed to it that they would not adopt it. Mr. C. Pearson, M.P., said that the plan just proposed was an old abandoned project, about to be carried out by Mr. Brunel, in connection with the Great Western Railway Company, when the joint-stock companies' panic prevented it. It was a new hare started; and, to test the sincerity of Mr. Boville, he publicly offered him (Mr. Boville) his seat in the direction of the Gas Consumers' Company. If he could do what he proposed, the public would very soon have the benefit of it. (This challenge was accepted by Mr. Boville.) Mr. Pearson then proceeded to detail, at very great length, the advantages offered by the Gas Consumers' Company, who would contract at a maximum price of 4s. per 1,000 cubic feet, and would, if possible, charge only 3s. per 1,000 feet. Mr. Deputy Stevens proposed a resolution pledging the meeting to support the Gas Consumers' Company, and binding them to give a pledge that they would either become shareholders or use the gas supplied by that company only. Mr. Pontifex seconded the resolution, and observed, that, as they were driven to competition in their own defence, let them carry out their scheme vigorously and well. He would at once sign the deed for thirty shares in the company, and he hoped that others would follow his example. Mr. Larby supported the resolution, and also took ten shares. The resolution was then put, and carried *nem. con.* The committee was then re-elected, with a request that they would watch over the interests of the Gas Consumers' Company in the progress of their act through Parliament; and, after a vote of thanks to the chairman, the meeting separated.

QUICKSILVER FROM CALIFORNIA.—On Monday, March 12, there were exhibited in the Exchange News-room of this town two large lumps of quicksilver ore, one of them weighing about 50lb., the other about half the size; they are the produce of Santa Clara Mine, in Upper California, belonging to Mr. Alexander Forbes, of San Blas, and brought here in the Admittance. It is supposed they contain from 60 to 70 per cent. of quicksilver.—*Liverpool Mercury.*

CUTTING OF DIAMONDS.—Although the diamond is the hardest of all known substances, yet it may be split by a steel tool, provided a blow be applied; but this requires a perfect knowledge of the structure, because it will only yield to such means in certain directions. This circumstance prevents the workman from forming facettes or planes generally by the process of splitting; he is therefore obliged to resort to the process of abrasion, which is technically called cutting. The process of cutting is effected by fixing the diamond to be cut on the end of a stick, or handle, in a small ball of cement, that part which is to be reduced being left to project. Another diamond is also fixed in a similar manner; and, the two stones being rubbed against each other with considerable force, they are mutually abraded, flat surfaces, or facettes, being thereby produced. Other facettes are formed by shifting the diamonds into fresh positions in the cement, and when a sufficient number are produced they are fit for polishing. The stones, when cut, are fixed for this purpose by imbedding them in soft solder, contained in a small copper cup, the part, or facette, to be polished being left to protrude. A flat circular plate of cast iron is then charged with the powder produced during the abrasion of the diamonds; and by this means a tool is formed which is capable of producing the exquisite lustre so much admired on a finely-polished gem. Those diamonds that are unfit for working, on account of the imperfection of their lustre or colour, are sold, for various purposes, under the technical name of bort. Stones of this kind are frequently broken in a steel mortar, by repeated blows, until they are reduced to a fine powder, which is used to charge metal plates, of various kinds, for the use of jewellers, lapidaries, and others. Bort in this state of preparation is incapable of polishing any gems, but it is used to produce flat surfaces on rubies and other precious stones. Fine drills are made of small splinters of bort, which are used for drilling small holes in rubies, and other hard stones, for the use of watch-jewellers, gold and silver wire drawers, and others, who require very fine holes drilled in such substances. These drills are also used to pierce holes in china where rivets are to be inserted; also for piercing holes in artificial enamel teeth, or any vitreous substances however hard.

SILVERING.—Copper and brass may be silvered in an apparatus by means of a solution of one part of fused nitrate of silver (lunar caustic) in five and a third part of aqueous ammonia; but the first immersion must not last longer than a second. (R. Böttger.)—Walker proceeds with a solution of cyanide of silver and potassium as the electrolyte, and a silver plate as the anode. According to Ruolz, who likewise uses cyanide of silver and potassium, silvering may be produced on gold, platinum, copper, bronze, brass, iron, cast iron, steel, and tin, and is very permanent. A solution of one part of cyanide of silver and ten parts of ordinary ferrocyanide of potassium in 100 parts of water may also be used.—(Dumas.)

TO CORRESPONDENTS.

"Nemo."—We will endeavour to ascertain, and let you know the result.

"J. M., Manchester."—Take of crystallized prussiate of potass and green vitriol, of each 6 parts; dissolve these two ingredients, each separately, in 15 parts of water. Mix the solutions, and add 1 part of oil of vitriol and 24 parts of fuming muriatic acid to the mixture. Agitate well, and let the mixture then stand at rest for a few hours. Add now, gradually and by small portions, a strained solution of 1 part of chloride of lime in 80 parts of water, and stop as soon as the mixture commences to effervesce (from the disengagement of chlorine gas). Let the mixture stand at rest for a few hours, to give time for the subsidence of the precipitate. Decant and filter. Wash the precipitate, and dry it at the common temperature, or by artificial heat. Or, take the precipitate which forms upon the addition of the oil of vitriol and muriatic acid, and wash it with dilute nitric acid until it acquires a deep blue colour.

"Incognitus, Birmingham."—We are always most willing to afford any information in our power; but really we cannot undertake to give medical advice. Even if we felt inclined to do so, how is it possible for us to know the nature and extent of the affection under which our correspondent seems to labour from the bare statement contained in his letter, that he feels pain all over, "which he thinks rheumatism, and ascribes to damp and cold"? Moreover, our correspondent seems to have a regular medical attendant. How can he expect us to interfere with that gentleman's directions? He asks us whether galvanism (which his medical attendant has recommended) will have a beneficial effect upon him and upon the disease from which he suffers. How should we know, unacquainted as we are both with our correspondent's age, constitution, &c., and with the nature of the disease under which he labours? With respect to the second question, white wax is usually meant; however, some practitioners prefer the yellow wax. As regards the third question, we do not know whether there is such a firm. We will, however, endeavour to ascertain, and let our correspondent know in next week's number.

"Th. L., Romney."—The following is the process for preparing brown pink:—Take of French berries and pearlash, of each 1 pound; fustic chips, ½ pound; water, 1½ gallon. Mix, and boil the mixture in a tin or pewter vessel, and strain through flannel while hot. Dissolve now 1½ pound of alum in 2½ gallons of hot water, and add the solution gradually to the strained decoction as long as a sediment continues to fall. Decant the liquid off the sediment, wash the latter, drain, and dry. Some persons omit the fustic.

"Inquirer, Nottingham."—Will our correspondent oblige us by sending another sample of the article?

"Chemist."—A private communication has been forwarded to the address indicated by our correspondent.

"Duty."—The article is liable to the stamp duty.

"B. C. R."—1. The Lycoperdon bovista. 2. Jussieu. 3. The book is out of print; you might, perhaps, get a copy at a stall. You will find one at the library of the British Museum.

"M."—Apply to the editor of the *Patent Journal.*

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—March 17, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE L.

(LECTURE LXXVIII.)

EXTRACTIVE.

Section VI.—EXTRACTIVE ASSOCIATED WITH RESIN AND ESSENTIAL OIL.—(*Concluded.*)

ROOTS OF THE UMBELLIFERÆ.

Those of the roots of the Umbelliferæ which abound in volatile oil are energetic stimulants. Such are the roots of angelica, masterwort, mew, skirret, &c. The volatile oil is extracted from these roots with difficulty only, since it is almost invariably associated in them with oily or resinous matters, which retain it strongly. It is this natural mixture which constitutes what is called "angelica balsam;" it is to this mixture also that is to be attributed the persistence of the aroma in these roots, even after protracted coction.

The less aromatic roots, such as those of parsley, fennel, carrots, are used as diuretics; and the two former constitute part of the so-called five aperient roots. The more succulent of these roots serve as articles of food (carrots and parsnips, for instance).

Coction increases their nutritive properties, by softening and swelling the cellular tissue, and tearing the cells which enclose the gummous and amylaceous matters.

The following are the principal species of the roots of the Umbelliferæ used in medicine:—

Archangelica officinalis,
Apium graveolens,
Daucus carotta,
Eryngium campestre,
Fœniculum officinale,
Imperatoria ostruthium,
Meum athamanticum,
Petroselinum sativum.

The root of angelica contains, according to Buchner, the younger:—

Volatile oil, mixed with a little volatile acid (angelicic acid),
A matter analogous to wax,
A crystallizable sub-resin (angelicin),
An amorphous resin,
A bitter principle,
Tannin,
Malic acid and malates,
Sugar,
Gum,
Starch,
Albumen,
Pectic acid.

The mixture of the resin with the essential oil constitutes the angelica balsam of Brandes and Bucholz. This balsam has a syrupy consistence, a blackish-brown colour, a very agreeable odour, and an acrid, bitter, and aromatic taste. It may be readily obtained by treating the alcoholic extract of the root with water, which removes the other principles and leaves the balsam undissolved.

The other strongly aromatic roots of the Umbelliferæ have not yet been analyzed, but it is probable that they have an analogous composition. Osan and Wackenroder found in the root of the carrot a species of crystallizable resin (earrotin). This resin is reddish-yellow, insipid, and inodorous; insoluble in water, and but sparingly soluble in alcohol. Ether dissolves it only in the state in which it exists in the root, *i.e.*, associated with the fatty oil of the latter. It dissolves readily in the fatty oils.

The carrot-root contains, besides the carrotin, according to Vauquelin's analysis:—

Albumen, or, rather, the peculiar nitrogenous matter common to several fleshy roots, and which induces so easily the viscous fermentation,
Mannite,
Crystallizable sugar,
Malic acid,
Pectic acid, and, undoubtedly, also gummous matters.

The mannite has been looked upon as a product of alteration of the root. M. Payen has, however, lately found an abundant quantity of this principle in the tuberculous stocks of the celery-radish, from which fact we might well conclude that mannite may, at a certain period of vegetation, be met with in these roots as one of the native constituents.

PRESERVATION OF THE ROOTS OF THE UMBELLIFERÆ.

The apothecary should lay in every year a fresh stock of the dry roots of the Umbelliferæ, as these roots lose gradually a part of their volatile oil; they are, moreover, exceedingly liable to become the prey of insects.

SPECIES.

DIURETIC SPECIES.

(*The Five Aperitive Roots.*)

Take of Dry roots of fennel,
" butcher's broom,
" smallage,
" asparagus,
" parsley, of each equal parts.

Incise the roots, and intermix them.

PULP.

The pulp of carrots is applied sometimes externally on ulcers, cancers, &c. It is prepared by grating the fresh roots.

PTISANS.

These are prepared invariably by infusion, in order to guard against the loss of the volatile principles.

Dose, 20 grammes of the roots per quart of water.

The ptisans of parsley, fennel, carrots, are used as diuretics. The ptisan of carrots is prepared with the fresh roots, by decoetion.

EXTRACTS.

The extract of the parsley-root is about the only one in use. To prepare it, reduce the root to the state of a semi-fine powder, moisten this with one half its weight of cold water, and lixiviate, taking care to pile the mass very lightly, as the parsley-root is viscous.

SYRUPS.

The simple syrups of the roots of the Umbelliferæ are rarely used; they are prepared in the same manner as the syrup of hyssop.

The roots of parsley, fennel, and smallage enter into the composition of the syrup of the five aperient roots.

SYRUP OF THE FIVE APERIENT ROOTS.

Take of Dry roots of smallage,
" parsley,
" fennel,
" asparagus,
" butcher's broom, of each 1 part.
Sugar syrup, 30 parts.

Cut the roots in thin slices with a knife, put the slices in a tin water-bath, and pour over them 20 parts of boiling water. Let the mass infuse for twelve hours, and throw it then upon a linen cloth. Let the liquid drain off without squeezing the mass, and keep the liquor in a cool place. In this manner you will obtain 8 parts of concentrated infusion. Replace the roots now in the water-bath, and make a fresh infusion with 32 parts of water. Strain with gentle expression. Decant the liquors, mix them with the sugar syrup, and boil until the whole forms a highly concentrated syrup. Add to this one fourth part of the first liquor, evaporate again, and reduce to 24 parts. Add now briskly the remaining three fourths of the first liquor, and strain.

The purpose which this manipulation is intended to answer is to make enter into the syrup the greatest possible proportion of the aromatic principles of the roots. It is with a view to this that part of the concentrated infusion is kept to be added to the syrup in the last instance, and after the termination of the process of evaporation.

I have in vain endeavoured to extract the roots by lixiviation with a small quantity of water, which would supply us with the means of making a syrup by simple solution; the aperient roots are too mucilaginous for this proceeding, and we are accordingly compelled to resort to the proeess just now described, and thus to sacrifice a portion of the aromatic principles by the evaporation of the liquors.

SAVIN.

Savin (Juniperus Sabina) contains a large proportion of resin and of volatile oil. It is an exceedingly acrid plant, which may produce inflammation on the skin, and which is on that account sometimes applied on wounds to destroy the proud flesh, and also to elean old ulcers. Given internally in large doses, it acts as an acrid poison: it causes inflammation of the stomach, whieh may terminate in death. In moderate doses it is an energetie stimulant. Its action bears more particularly upon the womb, where it determines the appearance of the catamenia in cases where their non-appearanee is caused by an atonie state of the tissues. The savin is given in powder at the dose of from 60 to 80 centigrammes, or in infusion at the dose of 4 grammes per quart of watcr. The alcoholic extract which is prepared with alcohol of 56C. (21° Cartier) is rarely used.

The essential oil of savin has, according to Dumas' analysis, the same composition as the essential oil of juniper and turpentine.

TINCTURE OF SAVIN.

Take of Savin leaves, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Let the leaves macerate in the alcohol for fifteen days; strain with expression, and filter.

EXTRACT OF SAVIN.

Take of Dry savin, 1 part.
Alcohol of 56 C. (21° Cartier), a sufficiency.

F.S.A.

The savin yields three and a half per cent. of its weight of extract.

POTION WITH SAVIN OIL.

Take of Essential oil of savin, 1 to 6 drops.
Syrup of mugwort, 32 grammes.
Orange-flower-water, 125 grammes.

Weigh the syrup in a phial, add the essential oil, mix the latter with the syrup by shaking the phial, and add the distilled water gradually to the mixture.

CERATE OF SAVIN.

Take of Savin powder, 1 part.
Simple cerate, 6 parts.

Mix.

Used as an epispastic.

ESCHAROTIC POWDER.

Take of Savin powder, 1 part.
Calcined alum, 2 parts.

Mix.

This powder has been employed with great success by Dr. Vidal, of Cassis, to destroy venereal vegetations (condylomata). Under its influence the vegetations dry and shrivel, and may then be removed without pain. They should be dressed with the escharotic powder twice a day.

RUE.

Rue (Ruta graveolens) is a plant possessed of very active properties, which have, however, not been clearly defined as yet. It should be used with prudence and caution.

It eontains:—

Volatile oil,

Chlorophyle,
Vegetable albumen,
Extractive,
Gum,
A nitrogenous matter,
Starch,
Inulin.

The volatile oil of rue has a greenish or brownish colour, and a strong and disagreeable odour; it concretes in the cold, forming regular crystals; its solubility in water exceeds that of any other volatile oil.

The volatile oil is considered to be the active principle of the plant. It would appear, however, that the plant is much more acrid than the oil; the aqueous extract of rue is, indeed, exceedingly acrid, and may cause inflammation of the intestines. There is accordingly reason to suppose that rue contains besides the volatile oil some fixed acrid principle which has as yet eluded detection.

The essential oil of rue is used as a stimulant, emmenagogue, and antispasmodic.

It is mostly administered in potions.

Rue is rarely given in the form of extract. The extract of rue is prepared with alcohol of 56 C. (21° Cartier).

The powder of the plant is used to destroy lice and to clean old ulcers. In infusion the plant is given as an emmenagogue and vermifuge. The infusion is also administered in clysters to stimulate the activity of the bowels.

OIL OF RUE.

Take of Incised dry rue, 1 part.
Olive oil, 8 parts.

Digest in the water-bath for twelve hours, strain with expression, and filter.

POMATUM OR OINTMENT OF RUE.

Take of Fresh leaves of rue,
" wormwood,
" mint, of each 1 part.
Hogslard, 8 parts.

Mix, and boil until the whole of the aqueous moisture is expelled; strain with expression, let the strained liquid cool, and remove the dregs.

JUNIPER BERRIES.

These berries are the fruits of the Juniper communis. The berries, or, to speak more correctly, the fleshy cones, of the juniper-tree contain :—

Volatile oil,
Wax,
Resin,
Extractive matter,
Saccharine matter,
Gum,
Salts of lime and of potass.

The saccharine matter, according to Trommsdorf, is crystallizable, and analogous to grape sugar. According to Nicolet, it partakes of the nature of molasses. The latter chemist obtained the resin of the juniper berries in a crystalline state by the following process :— He treated the aqueous extract of the berries with boiling alcohol; the alcoholic solution deposited wax upon cooling; he evaporated the liquid decanted off from the sediment to dryness, and diluted the residue subsequently with a little alcohol; the alcoholic liquid deposited the resin at the end of a few days.

The essential oil of juniper is colourless; its density is 0.911. It is sparingly soluble in alcohol. According to Dumas, it is isomeric with the essence of turpentine. M. Capitaine and myself have found that it is capable of combining with hydrochloric acid.

M. Trommsdorf has observed that the volatile oil predominates in the berries before their maturity; that in the ripe berries which have assumed a dark blue colour a portion of this oil is changed to resin; and that in the perfectly ripe black-coloured berries the whole of the oil is converted into the latter substance; at the same time the sugar is found to have almost altogether disappeared.

Juniper berries are used for stimulating fumigations, on account of the volatile oil and resin which they contain. They are also in certain cases placed in a charcoal warming-pan used to warm the bed of the patient.

PTISAN OF JUNIPER BERRIES.

Take of Bruised juniper berries, 8 grammes.
Boiling water, 1,000 grammes.

Let the berries infuse in the water for two hours.

This iufusion is given to dropsical patients; it acts as a gentle stimulant, and forms at the same time an excellent diuretic.

DISTILLED WATER OF JUNIPER BERRIES.

Take of Crushed juniper berries, any quantity you like.
Water, a sufficiency.

Distil in the steam apparatus, and draw off four parts of product.

EXTRACT OF JUNIPER.

Take of Slightly-bruised juniper berries, 1 part.
Water at 77° F., 3 parts.

Leave the berries in contact with the water for twenty-four hours; strain with expression, and evaporate to the consistence of an extract. Some apothecaries leave the berries whole, but I think it much better to crush them slightly; they yield more extract in that state than when entire, and I have ascertained that the extract prepared with the crushed berries is by no means inferior to that obtained from the berries used entire. Of course the result would be very different if ebullition were resorted to, since in that case a tolerably large proportion of resin would be dissolved, which would impart a certain degree of acridity to the product.

VIRGINIAN SNAKEROOT.

The root of Aristolochia serpentaria has been analyzed by Chevalier and Bucholz.

It contains :—

Volatile oil,
Soft resin,
Bitter extractive,
Gummous extractive,
Albumen,
Starch,
Salts.

M. Chevalier attributes the properties of the root to the presence of the bitter extractive. It is quite evident, however, that they are equally attributable to the presence of the volatile oil and resin.

The Virginian snakeroot is a very active general stimulant and tonic. It is given more particularly in adynamic fevers, when the inflammatory stage has passed.

It is administered usually in form of potion. The dose is 16 to 64 grammes of the root to one quart of boiling water.

It forms an ingredient of a great many stimulating and tonic preparations.

VALERIAN.

The roots of the plants of the Valeriana tribe have a strong odour and a disagreeable taste. Several of these roots are used in medicine. We use indiscriminately the root of the Valeriana officinalis and of the Valeriana phu. The roots of Valeriana celtica and of Valeriana saliunca were formerly used under the name of Nardum celticum. Spikenard is the cape and base of the stem of the Nardostachys jatamansi.

The root (of the Valeriana officinalis and Valeriana phu) is the only part employed in medicine. It is one of the most energetic stimulants and antispasmodics. It is found efficacious also in some cases as a febrifuge and anthelmintic.

According to Trommsdorf's analysis, it contains :—

Volatile oil,
Resin,
Aqueous extractive,
A peculiar matter,
Starch.

The medicinal properties of the valerian seem to reside chiefly in the volatile oil. This oil, when prepared by the ordinary process, contains:—

1. A volatile oil which exhales the odour of camphor, and has the same composition as essence of turpentine; it boils at 320° Fahrenheit. Gerhardt calls this oil *Bornëene;*

2. A small portion of a stearoptene (Borneol) which is produced by the fixation of water on the Bornëene. It exhales the smell of camphor and of pepper. This stearoptene is the same matter which constitutes the Borneo camphor (derived from Pterygrium teres); it is transformed by the action of nitric acid into the common camphor;

3. An oxygenated volatile oil (Valerol). This oil has a hay-like odour. It is composed of

$$C_{12}\,H_{20}\,O_2.$$

It acidifies in the air, and is transformed into valeric acid, a portion of it being at the same time converted into resin.

The valeric or valerianic acid exists always to a small amount in the fresh essence of valerian. The quantity of the acid increases with the length of time that the acid is exposed to the action of the air. This acid, which was first discovered by Pinter, has considerable analogy with the volatile fatty acids; it is liquid, oleaginous, and has a peculiar repulsive odour, greatly resembling that of the plant. It dissolves in 30 parts of water, and is soluble in all proportions in alcohol and in ether.

Ettling gives the composition of valerianic acid as :—

$$C_{10}\,H_9\,O_3.$$

The free acid contains 1 equivalent of water. It forms with water two other hydrates, containing respectively 2 and 3 equivalents of water. The latter of these hydrates, viz., that containing 3 equivalents of water, is decomposed by simple evaporation. Valerianic acid combines with bases. In the valerianates the oxygen of the base is as 1 to 3 to the oxygen of the acid. The valerianates have a peculiar smell, and a sweet taste, with saccharine aftertaste; nearly all acids expel the valerianic acid from its combinations.

Valerianic acid may be readily procured from the essential oil of valerian, by mixing the latter with water and magnesia, agitating briskly, and distilling. The oil volatilizes; the acid remains behind combined with the magnesia; from the latter combination the valerianic acid is separated by means of a stronger acid, and by distillation.

According to Dumas and Stass, valerianic acid is formed also upon the digestion or distillation of the volatile oil of potatoes with alkalis.

The resin of valerian is almost black; it has a strongly marked leather-like smell, and an acrid taste.

The aqueous extractive retains the same leather-like smell, which it owes undoubtedly to the presence of a little of the resin.

As regards the peculiar principle discovered by Trommsdorf, this requires still further examination.

VALERIANIC ACID AND THE VALERIANATES.

M. Brun-Buissou recommends the following process for the preparation of valerianic acid :—

Let 10 parts of valerian-root macerate for two days in 40 parts of water acidified with 1 part of sulphuric acid. Distil until the liquid which passes over ceases to redden litmus paper. Expose the distillate for one month to the air; neutralize it now with carbonate of soda, and evaporate to dryness at a gentle heat. Put the residue in a straight test-tube, and add to it a sufficient quantity of sulphuric acid diluted with its own weight of water; heat slightly: the valerianic acid will be found floating at the top. Purify it by distillation.

The effect of the exposure to the air is to oxygenize the alcohol, and to convert it into valerianic acid. M. Lefort, of Gannal, has since proposed to attain the same result by adding, before the distillation, a little chromate of potass to the mixture of valerian, water, and acid.

VALERIANATE OF ZINC.

The valerianate of zinc crystallizes in white, nacreous spangles, which are difficultly moist-

ened with water. Cold water dissolves the $\frac{1}{50}$th, boiling water the $\frac{1}{40}$th, of its own weight of valerianate of zinc. The salt dissolves in 6 parts of boiling water.

Valerianate of zinc is prepared by dissolving hydrated oxide of zinc in hot dilute valerianic acid, filtering the solution hot, and leaving the filtrate to spontaneous evaporation in the stove.

Valerianate of zinc is used as an antispasmodic in the form of pills, or in that of a potion, at the dose of 10 to 40 centigrammes per diem.

POWDER OF VALERIAN.

Pound the roots lightly in a mortar; sift through a hair sieve to remove the earth which adheres to the roots. Dry the clean roots in the stove, and reduce them subsequently to powder in the usual way, and leaving only a most trifling residue.

This powder must be kept in tight-stoppered bottles.

DISTILLED WATER OF VALERIAN.

Take of Valerian-root, 1 part.
Water, a sufficiency.

Distil, and draw off 4 parts of product.

The product is rendered acid by the valerianic acid which it contains.

The distillation of the valerian in the steam apparatus yields an excellent product. The dry root must, like all dry substances, be ground in the mill, the product moistened with half its weight of cold water, and the mixture left standing at rest for twelve hours before commencing the process of distillation.

POTION OF VALERIAN.

Take of Pounded valerian-root, 8 to 32 grammes.
Boiling water, 1,000 grammes.

Let the root infuse in the water.

We cannot as yet say whether infusion is preferable to decoction in the treatment of valerian. The process of ebullition unquestionably dissipates a portion of the volatile oil, and, if it have been rather long protracted, the liquor will retain only the leather-like smell which is proper to the resin. On the other hand, the decoction contains a larger proportion of the resin (which is unquestionably one of the active principles of the plants) than the infusion. Experience has shown, however, that the infusion prepared with the well-pounded root deserves the preference, since it is more sapid and odorous than the decoction.

SYRUP OF VALERIAN.

Take of Valerian-root, 1 part.
Boiling water,
Simple syrup, of each 8 parts.

Pound the root, put it in the cucurbite of an alembic, pour the boiling water over it, and let it infuse for ten or twelve hours. Distil, and draw off $1\frac{1}{2}$ part of product, which put aside. Strain and squeeze the mass remaining in the cucurbite; filter the liquid, and mix the filtrate with the sugar syrup. Boil until the syrup has lost a weight equal to that of the aromatic distillate. Let it partly cool, and mix the aromatic distillate with it.

I have tried several methods of preparing the syrup of valerian, keeping always the same proportion between the root and the sugar, as in the preceding formula. I have prepared it:—

1. By simple solution of the sugar in the infusion of the root in a close water-bath;

2. By evaporating the infusion of valerian with the syrup, and mixing the product subsequently with a little distilled water of valerian, according to the process of MM. Henry and Guibourt;

3. By digesting the powder of the valerian for several hours in double its weight of hot water, expressing subsequently, digesting the grounds in a fresh quantity of water, expressing again, evaporating the second liquor with the syrup, and diluting the product with the first liquor;

4. By dissolving thirty grammes of the alcoholic extract of valerian in 200 grammes of water, filtering, and mixing the filtrate with one kilogramme of sugar syrup which had been previously made to lose, by evaporation, a weight equal to that of the solution of the extract.

The product of the last of these four manipulations was the only one that came at all near that prepared according to the formula given above.

ALCOHOLIC TINCTURE OF VALERIAN.

Take of Valerian-root, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the root macerate in the alcohol for fifteen days, strain with expression, and filter.

The alcoholic tincture of valerian is an excellent remedy, which contains all the active principles of the root.

ETHEREAL TINCTURE OF VALERIAN.

Take of Valerian-root in powder, 1 part.
Sulphuric ether, 4 parts.

Operate by the method of displacement.

This tincture holds in solution the whole of the resinous matter, the volatile oil, and the valerianic acid; that is to say, all the active principles of the root.

EXTRACT OF VALERIAN.

Take of Valerian-root any quantity you like.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Reduce the root to the state of a semi-fine powder; moisten this with half its weight of alcohol; at the end of twelve hours lixiviate with three fresh parts of alcohol; displace the greater part of the alcohol by means of water. Distil the alcoholic liquors, and evaporate the residue to the consistence of an extract.

This process yields a quantity of extract corresponding to 25 per cent. of the root by weight.

The alcoholic extract of valerian is preferable to the extract prepared with water, since the alcohol is a better solvent of the active principles of the root, and, the process of evaporation being less protracted in the preparation of the alcoholic than in that of the aqueous extract, a less proportion of volatile oil is dissipated in the former than in the latter. The abundance of resinous matter in the alcoholic extract contributes also to retain in it a larger proportion of volatile oil.

The extract prepared with cold water, as recommended by some authorities, is less odorous.

The aqueous extract, prepared by infusion, approaches nearer to the alcoholic extract than the cold-prepared aqueous extract.

The approximative relative values of the different preparations of valerian are as follows, taking the root as the point of comparison:—

One part of the root corresponds to—
1 part of the powder,
0.25 part of the extract,
5 parts of the alcoholic tincture,
4 parts of the ethereal tincture,
8 parts of the syrup.

IRIS FLORENTINA.

(FLOWER DE LUCE.)

In the plants of the family of the Irides the most remarkable organ for its medicinal properties is the rhyzoma or subterranean stem, which is usually designated by the name of root.

We employ in medicine, in Europe, the roots of Iris florentina, Iris fœtida *seu* fœtidissima, Iris pseudo-acorus, Iris germanica, Gladiolus communis.

All these roots are acrid, and most of them are used as purgatives (the French peasants use the roots of Iris germanica and of Iris pseudo-acorus as purgatives). They form also ingredients of the compound purgative mellite of mercury. M. Récamier has given the root of Iris fœtida with great success in dropsy. The Iris florentina has analogous properties, though in a more feeble degree.

The acrid principle to which the properties of the roots of Iris florentina are to be attributed is not yet sufficiently known to us. Vogel has observed in these roots two matters which may both contribute to the medicinal action of the roots, viz., a bitter extractive matter, and a species of acrid oil. M. Lecanu has extracted from the root of Iris fœtida an acrid resinous matter and a bitter substance soluble in water; he feels inclined, however, to look upon the acrid volatile oil which accompanies these matters in the root as the active principle. I entertain on this subject a different opinion from M. Lecanu.

The root of Iris pseudo-acorus contains resin, but no volatile oil.

The root of Iris florentina contains, according to Vogel's analysis:—

An exceedingly acrid and very bitter fatty oil,
Volatile oil,
A yellow acrid matter, soluble in water,
Gum.
Starch.

The volatile oil of Iris is solid, nacreous, and laminar; it has the odour of violets. According to M. Dumas, it is composed of

$$C_4 H_8 O_1.$$

The carbon and hydrogen are present in it in the same proportion as in the hydrocarburetted gas.

On account of its violet smell, the Iris florentina is sometimes used to aromatize certain preparations.

On account of its acridity it is employed for the preparation of spherically-shaped peas which are used to facilitate the suppuration of issues.

The root of Iris florentina is given also internally; in large doses it would act as an emetic; but at the dose of a few grains it acts as a gentle stimulant on the lungs, and facilitates the expectoration at the end of chronic catarrhs.

POWDER OF IRIS.

Reduce the root to powder without leaving any residue.

COMPOUND POWDER OF IRIS.

Take of Iris florentina in powder, 1 part.
Sugar, 4 parts.

Mix.

LOZENGES OF IRIS.

Take of Iris florentine in powder, 1 part.
White sugar, 17 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of one gramme each.

TINCTURE OF IRIS.

(*Violet-water.*)

Take of Iris florentina in powder, 1 part,
Alcohol of 88 C. (34° Cartier), 8 parts.

Let the powder macerate in the alcohol for fifteen days, strain, and filter.

This tincture is used as a perfume.

Distillation would considerably impair the odour of the tincture.

RESINOÏD OF IRIS.

Take of Iris florentina in powder, any quantity you like.
Sulphuric ether, a sufficiency.

Operate by lixiviation, and leave the ethereal liquid to spontaneous evaporation.

The powder of iris yields by this process 0.04 of its weight of a whitish matter of the consistence of honey. This matter is used as an aroma. One part of it represents 25 parts of the powder.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE OXIDATION OF URIC ACID BY MEANS OF THE RED FERROCYANIDE OF POTASSIUM.

By M. A. SCHLIEPER.

When a mixture of the red ferrocyanide of potassium with potass is heated in conjunction with an organic matter susceptible of oxidation, the potass yields an equivalent of oxygen to the organic matter, and the red ferrocyanide is converted into the common yellow ferrocyanide of potassium.

This interesting reaction, which M. Mercier has already turned to advantage for the bleaching

of cotton tissues dyed blue with indigo, may be illustrated by the following formula :—

$$\underbrace{Cy_6\,Fe_2\,K_3}_{\text{Red ferrocyanide of potassium.}} + K\,O = \underbrace{2Cy_3\,Fe\,K_2}_{\text{Yellow ferrocyanide of potassium.}} + O.$$

M. Schlieper has investigated the action which this novel agent of oxidation exercises upon uric acid. For this purpose he diluted a solution of 150 grammes of uric acid in a slight excess of alkali with four to five quarts of water at 68° Fahr., and added to the liquid alternately potass and red ferrocyanide of potassium until the whole of the uric acid was decomposed. The attainment of this result consumed 615 grammes of red ferrocyanide of potassium, and about 300 grammes of potass. These proportions correspond to 1 equivalent of uric acid, $C_{10}\,H_4\,N_4\,O_6$, 2 equivalents of prussiate, and 6 equivalents of hydrate of potass. Accordingly, 2 equivalents of oxygen only had been set free in the reaction.

The alkaline liquid was now almost completely neutralized by means of pure nitric acid, which occasioned a copious disengagement of carbonic acid. At the end of a few days the neutralized solution deposited a notable quantity of allantoïn, rendered impure by the presence of a small proportion of a red substance which precipitates conjointly with the allantoïn, but constitutes simply an accessory product. The principal reaction is represented by the following formula :—

$$\underbrace{C_{10}\,H_4\,N_4\,O_6}_{\text{Uric acid.}} + O_2 + H_2\,O_2 = \underbrace{2C_4\,N_2\,H_3\,O_3}_{\text{Allantoïn.}} + 2CO_2$$

Besides these, some other purely accessory products are formed in the reaction. Thus, for instance, the action of the potass in excess upon the allantoïn already formed gives rise to a disengagement of ammonia, and to the formation of a certain quantity of oxalic acid. On the other hand, the liquor which had deposited the allantoïn yielded subsequently by proper treatment a small quantity of urea, accompanied by a highly deliquescent salt of potass with a peculiar acid, for which M. Schlieper proposes the name of *Lantanuric acid*. The composition of this acid he represents by the formula :—

$$C_6\,N_2\,H_4\,O_6 + HO = C_6\,N_2\,H_5\,O_7.$$

In M. Schlieper's opinion, the urea and the lantanuric acid are not the direct products of the reaction of the potass upon the allantoïn; but this reaction gives rise in the first place to the formation of a peculiar acid, called by M. Schlieper *Hidantoïc acid*, which subsequently resolves itself into urea and lantanuric acid. The author expresses the composition of the hidantoïc acid by the formula :—

$$C_8\,N_4\,H_8\,O_8 + HO = C_8\,N_4\,H_9\,O_9.$$

Upon this formula we can readily account for the manner in which the acid is formed. By adding to the elements of two equivalents of allantoïn the elements of two equivalents of water, we obtain one equivalent of anhydrous hidantoïc acid :—

$$2C_4\,N_2\,H_3\,O_3 + 2HO = C_8\,N_4\,H_8\,O_8.$$

The resolution of the hidantoïc acid into urea and lantanuric acid may be represented by the following equation :—

$$\underbrace{C_8\;N_4\;H_8\;O_8}_{\text{Hidantoïc acid.}} = \underbrace{C_6\;N_2\;H_4\;O_6}_{\text{Lantanuric acid.}} + \underbrace{C_2H_4N_2O_2}_{\text{Urea.}}$$

M. Schlieper recommends the following process for the preparation of the hidantoïc acid :—Dissolve allantoïn in a concentrated cold solution of potass; at the end of a few days the allantoïn will have disappeared. Neutralize the solution now by means of acetic acid, and precipitate the new acid by means of acetate of lead. (M. Schlieper derived this formula of the hidantoïc acid from the analysis of the lead salt.) You may now readily isolate the hidantoïc acid, by decomposing the hidantoate of lead with sulphuric acid, filtering the liquid, and evaporating the filtrate in the water-bath. By this proceeding you will obtain an acid syrupy liquid, which refuses to crystallize. Upon addition of alcohol to this liquid the hidantoïc acid will precipitate as a white mass, possessed of little compactness, and which will speedily deliquesce from absorption of mositure from the air. Hidantoïc acid precipitates chloride of barium and nitrate of silver from ammoniated solutions of these salts. The action of potass upon hidantoïc acid in the cold occasions disengagement of ammonia; and, upon evaporation of the alkaline liquid, flakes are deposited analogous to mycomelate of ammonia.

It appears difficult to reconcile this latter reaction with the decomposition of the acid into urea and lantanuric acid.

This subject certainly requires still further researches.—*Annalen der Chemie und Pharmacie*, vol. lxvii., page 214.

ON THE GEOLOGICAL STRUCTURE OF THE ALPS, CARPATHIANS, AND APENNINES, MORE ESPECIALLY ON THE TRANSITION FROM SECONDARY TO TERTIARY TYPES AND THE EXISTENCE OF VAST EOCENE DEPOSITS IN SOUTHERN EUROPE.

By Sir RODERICK IMPEY MURCHISON, F.R.S., V.P.G.S., &c.,

*Mem. Imp. Ac. Sciences of St. Petersburg, Corresp. Member of the Academies of Paris, Berlin, Turin, &c.**

This memoir, chiefly the result of the author's last excursion on the Continent, consists of three parts, the first of which is an endeavour to bring up to the present standard of knowledge the work on the Eastern Alps published long ago by Professor Sedgwick and himself, and to extend the survey from that portion of the chain to Switzerland and Savoy. The second part is a brief explanation of his present views respecting the northern flank of the Carpathian Mountains, and the third relates to Italy and the Apennines.

The Alps.—The central masses of the Eastern Alps, though in parts highly crystalline, contain recognisable remnants of Upper Silurian, Devonian, and carboniferous deposits, as proved by organic remains; but no traces of the Permian system† of the author, so abundant in Russia, Germany, and England, have been found in them or in any part of Southern Europe. In the same regions, viz., in the South Tyrol and the Salzburg Alps, the above-mentioned palæozoic formations are succeeded by trias, with true "muschelkalk" fossils, as recently expounded by Von Buch, Emmerich, Von Hauer, and other geologists. But, in following the central parts of the chain from Austria into Switzerland and Savoy, all fossil evidences of these palæzoic and triassic deposits cease; which, if ever they existed, have been obliterated by the very powerful action of metamorphism which has affected the Western Alps. The presence, however, of undoubted species of old coal plants in Savoy has led some geologists to believe that the carboniferous system had some representative there; whilst M. E. de Beaumont and M. Sismonda contend that the association of such plants with belemites proves that they occur in the lias of this part of the chain (Mont Blanc, Tarentaise, and Maurienne), so clearly recognised by its numerous animal organic remains. Sir R. Murchison allows, after personal inspection, that in the much-disputed locality of Petit Cœur the coal plants and anthracite really appear to lie in the same formation with the belemites as described by M. E. de Beaumont.

After a notice of the better acquaintance of geologists at this day with the fossils of the secondary rocks of the Alps than when Professor Sedgwick and himself described them, and after showing the great value of the Oxfordian group of Von Buch as the clear uppermost zone of the Jurassic limestones, the author goes to his chief point, and proves by a number of natural sections that the opinion for which his colleague and himself formerly contended, and which met with so much opposition, is at length completely established—that the flanks of the Alps exhibit a true transition from the younger secondary into the older tertiary strata. But, whilst this principle was correct, the author allows that his friend and himself were in error in applying it to the Gosau deposits, all the lower and fossiliferous parts of which he now admits to be cretaceous. In common with all the geologists of their day, they also formed an erroneous opinion of the age of the "flysch" in viewing it as secondary greensand.

He now specially refers, as the base of all his subsequent results, to a memoir of his own, read before the Geological Society in 1829 ("Annals of Phil. and Phil. Mag.," June, 1830), which proved that on the edge of the Venetian Alps, near Bassano and Asolo, the white and red scaglia, or chalk, is there conformably succeeded by the nummulitic and shelly deposits of the Vincentine, which are unquestionably of lower tertiary age, and graduate upwards through other shelly strata and sandstones into marls and conglomerates with sub-Apennine fossils. It has since been ascertained that deposits with the same shells, Echinidæ, and nummulites of older tertiary age, enter far into the higher Alps of the South Tyrol, and are there elevated to great heights on the surface of limestones which represent the chalk. Natural sections are then described in Savoy, Switzerland, and Bavaria, which show a clear ascending order from the Neocomian limestone (a formation unknown when he formerly visited the Alps), or equivalent of the lowest greensand of England, through a zone charged with fossils characteristic of the gault and upper greensand into a limestone containing Inocerami and Ananchytes ovata, which, whether of white, grey, or red colour, unquestionably stands in the exact place of the white chalk of Northern Europe. Certain conformable transitions from this inoceramus limestone up into shelly and nummulitic strata, like those of the Vicentine, are pointed out, particularly at Thones in Savoy, at the Hoher-Sentis in Appenzell, and near Sonthofen in Bavaria, where these intermediate beds, partaking of all the mineral characters of the great supracretaceous groups or "flysch," are still characterized by a Gryphæa, which is not to be distinguished from the G. vesicularis of the upper chalk. Above this zone (*i.e.*, in tracts free from dislocation and inversion) no traces have been discovered of any one fossil referable to the cretaceous system; the overlying strata being unequivocally nummulitic and shelly rocks, which are linked together by position and fossils, and which on the north flank of the Alps (especially at Sonthofen and Kressenberg), as well as on the high summits of the Diableretz and Dent du Midi, represent the lower tertiary of the Vicentine. The upper portion of this group, so vastly expanded on the north flank of the Alps, is a collection of shale, impure limestone and sandstone, the "flysch" of the Swiss, to a great extent the "Wiener Sandstein," or fucoid grit of the Austrians,* and the "Macigno" of the Italians. The whole group of nummulite rocks and "flysch," much loaded with chlorite, pre-eminently a "greensand," and often assuming a very ancient lithological aspect, is not, as many geologists (including himself) supposed, an upper member of the cretaceous rocks, but really represents the true eocene. The adoption of this view, which it is supposed all palæontologists must adhere to,

* Abstract of a memoir read before the Geological Society, December 13, 1848, and January 17, 1849.

† The term "Permian," derived from the vast region of Russia, where this uppermost Palæozoic system is more largely developed than in any part of the world hitherto examined, embraces in its meaning the Rothe Todtliegende, Kupfer Schiefer, and Zechstein of the German geologists, and, among the latter, Professor Naumann, Dr. Geinitz, and Captain Gutbier, have recently adopted the new term. In England the term includes the Lower Red sandstone, and the magnesian limestone. As far as researches have gone, it would appear that the Permian system is omitted in Southern Europe.

* In an able map of the Northern Alps of Bavaria and Austria, M. Morlot had placed the nummulite and flysch rocks above the chalk. Now, however, great confusion prevails among the Austrian geologists respecting the position of the "Wiener Sandstein," which has recently been mapped as "Keuper."

seems already to be also in great part taken by M. Boué, in opposition to his former opinion. In reviewing the physical relations of the upper secondary and lower tertiary rocks of the Alps, it is made manifest that the independence of any one member of this succession cannot be assumed from its unconformability to others in certain localities; inasmuch as such appearances are proved to be local phenomena only, by a more general survey which detects the order to be unbroken and continuous. In the Alps, therefore, as in Russia, where deposits of several ages are conformable, the limits of formations can alone be defined by their imbedded organic remains.

The author next developed the true age of the "Molasse and Nagelflue" of the northern portion of the Alps. Citing the researches of Prof. Studer, M. Escher, and others, he showed that the axis or older part of these tertiary deposits was usually removed to some distance from the higher ridges of cretaceous and eocene rocks, and consisted of freshwater strata; that the central or marine accumulations are from their fossils (as collected in the Cantons St. Gallen and Berne) of sub-Apennine or pliocene age, and that the great overlying portion of molasse and nagelflue, which frequently (owing to enormous dislocations) seems to dip under the older rocks, out of which it has been formed, is again, as far as can be ascertained, of terrestrial and freshwater origin. Following these deposits in ascending order to their outermost and superior zone, they are found to be surmounted by the well-known lacustrine formation of Œningen, formerly described in some detail by the author. The remarkable feature of this deposit is, that, although it has unquestionably been formed long after pliocene marine deposits (in which shells exist undistinguishable from those now living), its fauna and flora consist entirely of lost species. The examinations of its quadrupeds, chelonia, and reptiles by Herman von Meyer and Owen, of its fishes by Agassiz, and of its plants by Göppert, all lead to this conclusion. Even in respect to the insects of Œningen, Prof. Heer, of Zurich, has recently satisfied himself that in a multitude of species which he is about to describe not one is identifiable with a living form. Hence Sir Roderick maintains that the terms miocene and pliocene cannot be correlatively deduced from submarine and terrestrial formations; since, if this be done in Switzerland, types of lost terrestrial species overlie existing marine forms.

In concluding his observations on the Alps, attention was called to the extraordinary contortions and convulsions they had undergone. By diagrams of various transverse natural sections it was shown that the Oxfordian, cretaceous, and eocene or nummulitic groups had conjointly undergone such great flexures as in many instances to produce absolute inversions, and in others great ruptures, both longitudinal and transverse. Whilst the direction of the sedimentary rocks is shown to conform to the axes of certain great ellipsoids of crystalline rock, whether eruptive or purely metamorphic, the deviations from such conformity are very numerous, particularly where the strata wrap round the ends of each separate crystalline mass; in illustration of which a geological map of the Canton of Glarus, by M. Escher, was appealed so. Seeing that the forms of the anticlinal and synclinal folds exhibited in his sections coincided with the illustrations of the Appalachian Mountains and other chains recently produced by Prof. H. Rogers, the author —without offering any opinion on the theory of that able geologist—pointed out that in the Alps, as in the United States, the long and slightly inclined slopes of each anticlinal face the great centre of disturbance, whilst the short and steep sides of the same dip away from the chain. In reference to the very frequent phenomenon of the younger strata (including the molasse) dipping under the older, particularly along the line of great longitudinal faults, Prof. Rogers presented diagrams explanatory of such overlaps in accordance with his theory.

Carpathians.—A brief sketch, the result of a survey in 1843, is then given of the northern flanks of the Carpathian Mountains. Indicating the general succession northwards from the Tatra chain, the author points out how a mass of nummulitic limestone, overlying secondary rocks, dips under shale and sandstone like the flysch of the Alps, such deposits representing, as in those mountains, the eocene of geologists. An outer ridge (Zafflary and Rugosnik) of Oxfordian Jura and chiefly Lower Neocomian, according to Zeuschner and Keyserling, rises abruptly through these superior deposits, and between it and Cracow are undulating hills, much broken up and dislocated, consisting of sandstones, shale, &c., in parts of which Professor Zeuschner has discovered many secondary greensand or Neocomian fossils. These sandstones have a wide range, extending into Moravia, and doubtless constitute a large portion of what has been termed Carpathian grit. But the author observes that in tracts like this, where the cretaceous system assumes an arenaceous and earthy form, and particularly in those districts where the nummulitic limestones no longer exist, it is exceedingly difficult to draw any clearly defined line of separation between sandstones of secondary and tertiary age. He therefore believes that under the name of "Gres des Carpathes" rocks both of eocene and cretaceous age have hitherto been confounded, and that arguments concerning the age of any given portion of these sandstones in a country so constituted and so full of dislocations are valueless without the test of organic remains.

The Apennines.—A general view of the structure of Italy is then offered; and, whilst on the authority of General della Marmora the existence of Silurian rocks in Sardinia is cited, it is shown that the lowest fossiliferous deposits of the Peninsula are liasso-jurassic, followed by limestones, often of red colours, of Oxfordian age (*ammonitico-rosso*). These constitute a number of parallel ridges of various altitudes, overlaid by or forming troughs with younger accumulations, and thus forming numerous backbones of which the Apuan Alps and their crystalline marbles, the hills of La Spezia and Pisa, are the most prominent examples in the North.

Admirably exposed on the flanks of the Venetian Alps, and scarcely less so at Nice, the cretaceous system in all its members (from the Neocomian limestones of foreign geologists or equivalents of the English lowest greensand up to the white chalk inclusive) is surmounted by nummulitic eocene deposits, which near Asolo and Bassano are followed by miocene and pliocene shelly strata. After showing how they occupy a trough between such Alps and the Euganæans, the author explains how the latter hills have recently been described by M. de Zigno as composed of Oxfordian Jura and a full cretaceous system up to the white chalk inclusive, overlaid by the nummulitic group. In Liguria, Modena, Lucca, and Tuscany, such clear evidences do not exist; for there the formations above the Oxfordian Jura are singularly devoid of fossils, and the series between that horizon and the deposits of miocene age, with the exception of certain flaggy limestones (*Alberese*), assumes an arenaceous type. At very rare intervals only, and chiefly to the south of Florence, are any bands of nummulites observable; but where they occur the author refers all the "macigno" sandstone which is associated with or overlies them to the eocene epoch; such rocks being perfectly undistinguishable from the "macigno Alpin," or flysch of the Alps. As, however, these rocks repose upon others, including vast thicknesses of the Alberese limestone, so largely seen in the Apennines between Bologna and Florence and in the northern part of the Tuscan Maremma, it is presumed that much of the latter may represent the chalk. For although these rocks contain fucoids, one or more of them being said to be similar in species to those which overlie the nummulite strata of the Alps, no sort of reliance can be placed on the presence of such marine vegetables, which in the Alps range from the lower chalk high into the eocene; whilst in Tuscany an ammonite and a hamite have actually been found in these infranummulitic masses. The inference of the author is, that Professor Savi, though correct in viewing a portion of this series as cretaceous, has erred in including it in the nummulitic rocks.

In paying a just tribute to the talents, labours, and character of the lamented Professor Pilla, the author avows the impossibility of admitting his term of "Systema Etruriano" as an equivalent for any true geological division, as in it are comprehended strata which that writer had admitted to be cretaceous, with others which it is the chief object of his memoir to establish as lower tertiary.

In passing into the Papal States and Naples, the superposition of the nummulitic limestones with their usually associated fossils to hippuritic limestones, the equivalents of the chalk, is seen to be resumed; and thus the same general succession as in the Alps and Carpathians is maintained. Cases illustrative of this order, with much overlying macigno, are pointed out in the Sabine Hills and in the kingdom of Naples.

A transverse section of the Monferrato Hills (Superga) near Turin exposes a most instructive tertiary succession. A coralline concretionary limestone with small nummulites (Gassino), though described and mapped as cretaceous by Collegno and others, is shown to lie at the top of the eocene or bottom of the miocene, and to pass up through conglomerates, marls, and sandstones replete with the well-known miocene types of the Superga into the blue marls and yellow sands of the Astesan, which are of sub-Apennine age. The great interest of this section lies in its exposure of a vast thickness of intermediate beds, in which the per centage of recent and fossil species is of so mixed a character, that for a league across the inclined strata the able palæontologists, E. Sismonda and Bellardi, who made the section with the author, found it impossible to draw a defined line between miocene and pliocene accumulation, so completely do they inosculate.

After describing the relations of the miocene and pliocene formations near Bologna and in the Tuscan Maremma, including the great coal beds in the latter, which are believed to be of the older miocene date, the relations of all these marine tertiary deposits to younger terrestrial and freshwater travertines and limestones is traced; and reference is made to the more recent changes in the configuration of the Campagna di Roma and valley of the Tiber, with allusions to the labours of Monsignore Medici Spada and Prof. Ponzi, from whom he announced future communications; the one on the igneous rocks of Latium, the other on the sedimentary deposits of the Papal States.

After briefly recapitulating the principal phenomena in the Alps, Apennines, and Carpathians, the author dwells in conclusion on the chief aim of his present communication, viz., the establishment of a true equivalent of the eocene in Southern Europe. He analyzes the writings of the geologists who have recently described the nummulitic formations in the south of France, viz., Leymerie, Pratt, D'Archiac, Delbos, Raullin, Tallavignes, Rouant, &c., and indicates how their facts and his own are in harmony in showing the superposition of such deposits to the true cretaceous system, no characteristic fossil of which has been continued into the nummulitic group. Two or three species of Gryphææ are alone common to the upper beds of the one and the lower beds of the other. All the other fossils associated with the nummulites, whether from the Vicentine on the south or from Sonthofen and Kressenberg on the north of the Alps, are of tertiary forms, a certain number of them being absolutely identical with species of the London and Paris basins. Looking to the very great thicknesses and fine lamination of these accumulations, including the shale, sandstone, and limestone above the nummulites in the Alps, it is contended that, as all

these surmount the white chalk, they must be an equivalent in time of what is legitimately eocene, and that they do not merely represent, as suggested by that eminent geologist, M. E. de Beaumont, the interval which in the north of Europe has occurred between the termination of the chalk and the commencement of the plastic clay.

Extending the application of his view to still more southern and eastern regions, Sir Roderick Murchison is of opinion that the great masses of the nummulic limestone of the Crimæa, Africa, Egypt, and Hindostan are also of eocene age; or, in other words, that from the Carpathians to Cutch, at the mouth of the Indus, a space of not less than 25° lat. has been occupied by sea-basins in which creatures of this era lived. In reference to Egypt, he cites copious collections of shells and nummulites, chiefly those at the Royal Museum of Turin, examined by M. Bellardi and himself; and, in regard to Hindostan (after reverting to the Cutch fossils collected by Grant and described by Sowerby), he pointedly dwelt on the rich and instructive supplies of them recently sent home to him by Captain Vicary from Scinde and Sabathoo, and examined by Mr. Morris, which not only demonstrate the existence of this same group in the Hala range, extending northwards towards Cabul, but also along the southern edge of the Himalaya Mountains.

The inference then is, that it is necessary to separate the vast nummulitic formation, which the author believes to be eocene, from the cretaceous system with which it has hitherto been merged, and hence that a great change must be made in geological maps and in the classification of the rocks of this age in South Europe and other parts of the world. The union of the nummulitic and cretaceous groups in one system has been almost exclusively based upon the prevailing phenomenon of both having undergone the same movements, and having been often elevated into the same peaks and ridges. But such agreement in physical outline cannot be admitted as invalidating the clear testimony borne by organic remains, and from the study of which Brongniart, Deshayes, Agassiz, D'Orbigny, and Bronn have all placed the nummulitic group as lower tertiary. Patient geological researches, therefore, at length prove that, when clear from obscurities and unbroken, the order of superposition is in harmony with the distribution of animal remains.

[P.S. In the course of the memoir, of which it is difficult to explain even the chief points in an abstract, the author particularly cites Professors Studer and Brunner, jun., and M. Arnold Escher von der Linth, as having rendered him very great services in his examination of the Swiss Alps. In reference to Savoy, he mentions the Canon Chamousset and M. Pillet; and, respecting the Eastern Alps, he points out the assistance he received, first from the co-operation of his old associate, M. de Verneuil, in his re-examination of Styria, Gosau, &c., and afterwards from M. Leopold de Buch, to travel with whom through any part of that chain is to ensure good results. It was when with M. de Buch and M. de Verneuil that he explored the Triassic deposits of the South Tyrol. In attending the Venetian meeting of the Italian "Scienziati," in the autumn of 1847, the author further necessarily acquired much additional knowledge there from intercourse with the geologists who have worked out the details of that region, including Pasini, Catullo, and De Zigno, and he was then led to institute comparisons between some of the results of the Marquis Pareto in the western shores of the Southern Alps, and with those of the Austrian geologists, V. Hauer, Morlot, &c., in the East, as well as from that excellent palæontologist, M. Ewald, of Berlin. But as at that time Sir Roderick had not examined either the Swiss and Savoy Alps, the Monferrato, Apennines, or Southern Italy, any words he may be cited as having spoken at that meeting are not to be taken as affecting his ultimate conclusions expressed in this memoir. Since it was read he has received a letter from M. Alcide d'Orbigny, which he willingly cites, both as confirming his general conclusions and as bringing these deposits into close comparison with the lower tertiaries of Northern Europe. "For three years," M. d'Orbigny writes, "I have made the most extensive and most general researches on the strata containing nummulites; and, in comparing all the stratigraphical and palæontological results, it is impossible not to recognise therein two distinct epochs superposed the one to the other, and having each its proper fauna. One of these epochs, which I have recognised in the French Alps, the Pyrenées, and the Gironde, corresponds to the plastic clay of Paris and London, and which, belonging to the lower sands of Soissons, I have named 'Étage Suessonien'; the other, equally common in the Alps and the basins of the Gironde, and which includes the 'Calcaire Grossier' of Paris up to the gypsum of Montmartre and the London clay, &c., I designate 'Étage Parisien.' These divisions, based upon a considerable number of facts, are detailed in the work I am now printing, and the entire composition of their characteristic faunas is given in my 'Prodromus of Universal Palæontology.' The habit I have acquired of determining these fossils makes me regret that I cannot go to inspect your collections in London; but the portions of them I have seen in the hands of our friend M. de Verneuil have led me to recognise at once what I was already acquainted with in the Pyrenées and the French Alps. Again, the fossils I have examined in the collection of M. Tchichatcheff confirm me in my opinion, and would lead me to extend the limits of these tertiary stages, as you have suggested, through Asia Minor and other tracts even to Hindostan."

It may be added that, in citing the able memoir of M. Coquand, Sir Roderick has expressed his opinion that the data, though construed differently by that author, may be so interpreted as to lead to the conclusion that the mass of the rocks containing nummulites in the Barbary states and the shores of the Mediterranean are, like those of the Alps and Apennines, supra-cretaceous; his own limited observations in the Neapolitan territories being confirmed by the local knowledge of Professor Savi. Similar conclusions are, he thinks, inevitable respecting the nummulitic rocks of Egypt on the part of any one who has read Russegger's work on that country. At the same time, though well assured of his own facts, he would not contend against the possible existence in certain southern regions, not examined by him, of some one species of nummulite in strata of the age of the uppermost chalk, as insisted upon for the Crimæa by M. Dubois de Montpereux, and for Cape Passaro in Sicily by M. Constant Prevost. All that he contends for is, that the great nummulitic group, as characterized by a multitude of species of shells, echinoderms, nummulites, &c., is a formation superior to and distinct from the chalk; and, if there be situations (which, however, he has never seen) in which a species of nummulite be common to the uppermost chalk and lowermost tertiary, they would only the more confirm his view of transition from the one epoch to the other in some regions of the surface of the globe. In the memoir about to be published the author will give the result of the comparison of the species of the nummulites, whether collected in the Alps or Hindostan, with those of the south of France by M. le Vicomte d'Archiac, who has obligingly compared them.]

ACTION EXERCISED BY DIVERS LIQUIDS UPON ZINC AND ZINC-PLATED IRON.

By M. SCHAEUFFELE.

The experiments were made with the following liquids:—

Brandy,
Wine,
Orange-flower-water,
Vinegar,
Olive oil,
Rich broth,
Skimmed broth,
Milk,
River water,
Distilled water,
Selter water,
Salt water (brine).

These liquids were introduced respectively into twelve vessels of zinc and twelve of zinc-plated iron. The brandy in the zinc vessel was found to contain traces of that metal from the very first day; that in the zinc-plated iron vessel showed no traces of zinc the first day, but gave indications of the presence of that metal after twenty-four hours' sojourn in the vessel. The wine was left in contact with the metal for twenty-four hours, when it was in both vessels found to contain a tolerably large proportion of dissolved metal. The orange-flower-water gave the same result as the wine. But of all the liquids examined the vinegar was found to have acted the most energetically upon the zinc. In the olive oil, on the other hand, not the faintest traces of metal could be discovered, even after fifteen days' sojourn in the vessels. The thin and skimmed broth was in both vessels found to contain zinc after twenty-four hours' contact; the milk, also, in both vessels, after forty-eight hours' contact; the rich and fat broth only at the end of four days. In the selter water and the brine traces of metal were detected after twenty-four hours' sojourn in the vessels; in the distilled water only after five days, and even then only in the zinc-plated vessel. The river water gave indications of the presence of metal at the end of thirteen days only.

With respect to the comparative and relative quantity of metal dissolved respectively in the zinc and the zinc-plated vessels, it may be stated as the general result that the liquids examined attack the latter more energetically than the pure zinc. Two liquids only, the brandy and the brine, form an exception from this rule.

The energy of the action of the vinegar upon the zinc may be judged of from the fact that one quart of this liquid was found to contain, after twenty-four hours' sojourn in the zinc vessel, 31.75 grammes, as in the zinc-plated vessel 60.75 grammes of oxide of zinc.

Next in energy of action to the vinegar, but a very long way behind, come the milk, wine, and broth; the milk, which of the three acts most energetically, dissolved only five grammes of the metal in the zinc vessel, and seven grammes in the zinc-plated vessel.

These researches and the results to which they have led are highly interesting for domestic hygiene. It appears from them that zinc vessels are preferable for culinary purposes to zinc-plated iron vessels, but that both the zinc and the zinc-plated vessels are attacked energetically by acid liquids, in a less degree by milk, and in a much less degree still by fatty liquids, such as broth, for instance. And, although the oxide of zinc cannot precisely be said to be poisonous, yet there can be no doubt but that its habitual use in large doses must seriously affect the organism.—*Journal de Chimie.*

ON THE COMPOSITION OF GOLD FROM CALIFORNIA.

By T. H. HENRY, Esq., F.R.S.*

Gold as found in nature is never chemically pure, being combined with variable proportions of silver and traces of iron and copper, and occasionally it occurs with palladium and also with tellurium.

The amount of silver was found by Boussingault, in a series of analyses of the native gold of Columbia, to vary between 2 and 35 per cent., from which he drew the conclusion that the gold and silver were combined in atomic propor-

* Communicated by the author to "The Philosophical Magazine."

tions, 1 atom of silver being constantly combined with more than 1 atom of gold. The specimen containing 35 per cent. of silver he considered to be a compound of 1 atom of silver and 2 atoms of gold, $Ag\ Au_2$; and that containing 2 per cent. of silver 1 atom of silver and 12 of gold, $Ag\ Au_{12}$.

This view of Boussingault was controverted by Gustav Rose, on his return from his celebrated journey to the Ural Mountains, theoretically, on the ground that gold and silver were isomorphous bodies; and such substances are not generally met with combined in atomic proportion. "It would be as remarkable as if antimony, arsenic, and tellurium were found combined in atomic proportion," he remarks;* "but as isomorphous substances do sometimes occur combined in atomic proportion, as in bitterspar, diopside, &c., the only remarkable result of the analyses of Boussingault is, that the gold and silver should be constantly so combined;" and experimentally by the analyses of several specimens of native gold from the Ural Mountains, in the greater number of which no such definite composition existed.

The purest specimen analyzed by Rose contained 98.96 per cent. of gold and 0.16 per cent. of silver; the others contained from 60 to 94 per cent. of gold.

The gold from California, a small quantity of which I obtained from Mr. Tennant, of the Strand, was taken from a quantity of about 60 lbs. weight, and was considered a fair average sample of the whole: the greater part of it was in the form of flattened grains or spangles, varying from $\frac{1}{20}$th of a grain to 2 or 3 grains in weight; one piece, however, weighed upwards of 30 grains: the surface was rough and irregular, with minute portions of siliceous matter imbedded in it. The specific gravity of a number of the smaller grains taken together by the bottle was 15.96; an analysis was made of these by treating them with aqua-regia, separating the chloride of silver, after dilution, by decantation of the solution of gold, and the chloride of silver, after having been well washed, dried, and weighed, was dissolved in ammonia, leaving a white siliceous residue, but no gold. The solution of the gold was, after the destruction of the nitric acid by heat and hydrochloric acid, digested with oxalic acid until all the gold was precipitated; the acid solution from the precipitated gold was treated with sulphuretted hydrogen; the precipitate of sulphuret of copper produced was ignited strongly, the metal estimated from the oxide, and a minute button of metallic copper was procured from this by the blowpipe. After the precipitation of the copper the solution was evaporated to dryness, the oxalic acid was expelled by heat, leaving a minute quantity of chloride of iron,† which was dissolved in water acidulated by hydrochloric acid, and precipitated by ammonia. The gold precipitated by the oxalic acid was entirely dissolved by aqua-regia. In this manner these grains were found to be composed of per cent.:—

		Or after abstraction of Siliceous Matter.
Gold	88.75	90.01
Silver	8.88	9.01
Copper, with trace of iron	0.85	0.86
Siliceous residue	1.40	—
	99.88	99.88

The larger piece or "pépite" weighed 30.92 grains, and its specific gravity was 15.63. After being flattened out on a polished steel anvil until it appeared free from foreign matter, and gently ignited, it weighed 30.24 grains, and the specific gravity was now found to be 16.48.

10.96 grains, mostly of this larger piece, were analyzed in the manner described above, and were found to consist of in 100 parts—:

Gold	86.57
Silver	12.33
Copper	00.29
Iron	00.54
	99.73

0.688 grain of this larger mass, assayed by the blowpipe by the method described by Plattner,* gave 86.33 per cent. gold; and a very thin spangle, which weighed 0.483 grain, and after fusion and separation of the siliceous matter .461, gave 85.03 per cent.

I could detect no platinum, palladium, or any of the metals usually combined with them, such as osmium, iridium, &c., in this gold; but the small amount at my disposal would not allow me to employ a quantity sufficient to enable me to pronounce absolutely on the absence of any traces of them.

The remark of Dumas ("Traité de Chimie appliquée aux Arts," tome iv., p. 434), that the proportions of gold and silver are so nearly constant in the mineral from the same locality (gisement) that the assayers know the composition when they have ascertained the precise locality which furnished it, is not confirmed by the above analyses, in which the gold varies from 85 to 90 per cent., nor, indeed, by those of Prof. G. Rose, of four specimens of gold from the same spot (Boruschka), which contained respectively 5.23, 8.35, 9.02, and 16.15 per cent. of silver.

This gold has very nearly the colour of the pure metal; after fusion, however, it becomes of a brass-yellow colour. This fact, together with the grains under the microscope, would almost induce one to believe that the surface of the grains was purer or "finer" than the interior, and that a portion of the silver had been removed from the surface by some chemical agent in nature. Prof. G. Rose, at the end of his memoir already quoted, refers to the opinion prevalent both in the Ural and at St. Petersburg, that the gold from the washings is purer than that from the mines, and appears successfully to combat both this opinion and the speculations of Férussac, who would account for it by the action of sea-water, &c.; but I must refer the reader to his memoir for his arguments, which are of great interest.

* Poggendorff's "Annalen," vol. xxiii., p. 164.

† Unless the oxalic acid has been prepared by sublimation, a small quantity of carbonate of lime will be left after dissipation of the acid.

* "Probirkunst mit dem Löthrohre." Leipzig, 1847.

THE CHEMICAL TIMES.

SATURDAY, MARCH 24, 1849.

THE CALIFORNIAN GOLD MINES.

To the curious and unoccupied a more tempting field of speculation than the results to be anticipated from the discovery of the Californian gold mines has seldom offered. An occurrence so rare in history, and still more singular as the crowning event of successful aggressive warfare, appeals strongly to the imagiuation, and sorely tempts to venturous prediction. Happening in the course of an European migration, and stamping it, as it were, with a seal of its own, the fact is invested with a mystic interest which may well inspire with poetic fervour the bard of some modern Edda or Niebelungen Lied destined perchance to reveal to the fortieth century the wondrous tale of a long-forgotten world. Legeud, which has made the outcropping ores of the Cevennes the attraction that drew the Tyrian Hercules to Southern France, and the grape the bait that enticed the Gaul into Italy, may tell also how, lured by yellow sands, the Teutonic race overflowed the vast American continent, and anticipated in the establishment of a new society the downfal of the old.

Altogether distinct from the dreams of fancy is the laudable desire to ascertain, by recurrence to precedents and a large generalization of existing facts, the influence, immediate and remote, to be apprehended from this discovery on the great interests of commerce and manufactures, on production and distribution, on the employment of labour and its direction into this or that channel, on the increase of population, the value of property, and the innumerable contingent interests; in one word, upon the great question of the progress of our race. That these are the issues concerned here must be obvious to every one who has learned from the pages of history the great anxiety of every nation to acquire possession of the precious metals, and the power which that possession in any great degree never fails to confer, for a time at least. Remembering the apprehensions to which the earlier announcements of this discovery gave origin, and bearing in mind that the credibility of the first statements has not been shaken or even challenged in any important particular, nay, that more extensive discoveries of gold districts have still more strongly confirmed the original reports, we might ask, how it is that the alarms, the hopes, and the speculations to which they gave rise have apparently so quickly subsided? The political economist saw in the anticipated depreciation of gold the annihilation of half the national debt; the long leaseholder rejosced in the expectation of a virtual remission of a moiety of his rent, while the fundholder and landlord were filled with apprehensions of a corresponding loss; the merchant calculated with increased caution the worth of foreign bills; and old brokers expected to have to learn a new standard of exchange. Money was to be revolutionized like politics. We hear nothing of this kind now. The fact, we are now told, will be gradual—bullion *must* come down, but it will take *time*. We think the calculations from which these conclusions have been drawn are unsupported. For this opinion of ours we will here assigu a few reasons, simply premising an observation with regard to the time which would be necessary to accomplish such a revolution in values, assuming the action and influences of the actual facts and circumstances to be sufficiently powerful to bring it about. Adam Smith tells us that it took seventy years to make the influence of the discovery of the South American gold mines on values sensibly felt in Europe. Many receut writers have inferred from this statement that there is some peculiarity about the exploitation of gold mines, or the traffic in their products, which removes gold from the ordinary laws of value, viz., supply and demand on one hand, and cost of production on the other. But, if we look more closely at the facts, we find that the tardiness of the effects and influence of that discovery was attributable simply to certain specific causes which are no longer in operation now. Thus, for instance, not only were all means of communication of a low order at the period to which Adam Smith's observations relate; roads ill made, if, indeed, existing at all, in those re-

mote countries; shipbuilding and navigation, comparatively speaking, in their infancy; but all the operations of the agents of commerce, from Francisco Doria down to his most humble correspondent's humblest servant, were carried on in a most circuitous manner and at a snail-like pace. The policy of nations, moreover, was opposed to that free interchange which has existed during the present and much of the last century, and the tendency of which is to equalize the distribution of natural produce throughout the world.

Arbitrary power, also, especially where held by a precarious tenure, has a direct tendency to limit and clog the operations of industry, and thus to discourage the production of the circulating medium. In the case of the American gold mines this disposition showed itself at first in violent interference with the working, and at a later period in the imposition of an oppressive tax on the article produced. The King of Spain's tax till 1736 was one fifth the standard value of the metal; and the actual proprietor of the mine was fain to take no other acknowledgment from the mining farmer but that he would grind the ore at his (the proprietor's) mill, paying no more than the ordinary price of grinding. But for the tax the fifth part of the value of the gold produced would have belonged to the landlord. Thus every inducement to honest enterprise was taken away by an iniquitous tax. A proper consideration and appreciation of these facts will account for the little influence which the last great discovery of gold had for nearly a century, and will also, we think, demonstrate the error of those who, although believing that a supply of gold sufficient to disturb the balance of the European market may be derived from California, yet would assign a long term before the operation of that cause shall make itself felt. It is no exaggeration to say that the advantages of capital, skill, knowledge of the natural properties of gold, machinery,—in short, of everything that aids and facilitates the operations of man,—are enjoyed in a sevenfold degree by this generation, compared with the men who discovered the riches of Peru and the Brazils; while our railroads and telegraphic systems, commercial organization, and enterprise, place our condition out of all parallel with theirs. Accordingly, assuming the discovery of the Californian gold districts to cause a revolution in value, a space of ten years would be amply sufficient to accomplish the event.

But we will now, on the other hand, proceed to adduce a few considerations which have convinced us, not, indeed, that any of the glowing statements to which currency has been given in the public prints are untrue, or greatly exaggerated, but that the expectations in reference to the value of bullion, and, accordingly, of the currency, will not be realized.

Along nearly the whole length of North America runs a vast mountain chain, forming, as it were, the *backbone* of that continent; of this great chain. the Sierra Nevada of California is an outlying section. As usual in all ranges, it is intersected by watercourses, which, by the disintegration of the rocks, have in the course of ages formed the alluvium in the valleys, in which the greater portion of the gold is now found deposited. In the able report of Captain Freemont, the head of the exploring expeditions sent out by the United States Government, we look in vain for any information on the geological structure of this mountain range. The object of the explorations was a military and topographical survey of the country; and, as the expedition was unaccompanied by a geologist, the observations on stratification, &c., are too imperfect for us to venture to base on them any reliable calculation regarding the probable amount of precious metal which the mountains may contain.

We are accordingly here entirely restricted to reasoning from analogy, a reasoning which may be considered in this instance nearly as rigorous and conclusive as if it were based upon actual facts and data in the case before us, for it is not very probable that the auriferous deposits in California differ materially from other similar deposits in the Old and New World. There is scarcely a range of mountains that does not contain more or less of auriferous deposits, the discovery of which in watercourses has, from time to time, excited as ardent hopes as the discovery of those in California. Humboldt, Hoffman, and Murchison, agree in opinion that gold is diffused in the crust of our earth in very minute quantities. These distinguished geologists and philosophers have come to the same conclusions even respecting the Ural placit in Siberia, and the Altai range in Asia, which have latterly yielded a more abundant supply of the metal than any other quarter of the globe. It is a curious fact that no very rich vein has been found at any considerable depth, from which it is natural to infer that, to express ourselves in the language of geology, the auriferous formations are of recent date. Of the Ural deposits Murchison says:—"Gold alluvia being the detritus of veins which once existed in the adjacent rocks, it might be supposed that in piercing those rocks the miner would find more copious stores of gold. Experience, however, has taught us that such is not the fact, and, to whatever cause due, it is certain that the veins which rise from great depths in the crust of the earth are richly auriferous in their upper *limit only*."

Such is also the experience of the miners in Mexico, Peru, and Brazil. The quantity of gold diminishes in proportion as the miners dig deeper below the surface, and at the depth of a few feet the production of the metal ceases altogether. The accounts which have been sent to this country from California have simply given us the experience of unscientific adventurers who have not extended their researches far beyond the immediate vicinity of the watercourses, where, as first comers, they obtained with facility the deposits of many centuries. This is not an uncommon occurrence; the placers will be ransacked, as many have been before, and, when this shall have taken place, the alluvium of the plains will, perhaps, present no richer washings than those known to exist in other parts of the world, and many of which do not even pay the expenses of working them. It is a mistake to imagine that the masses of gold lately found in California are without precedent for size. In the alluvial grounds of New Granada, at Choco, a *pepita* of gold was discovered weighing 27½ lbs. avoirdupois; and in the diggings of Cabarras, North Carolina, U.S., another lump weighed 28 lbs. Indeed, it may be said of nearly all the extraordinary facts related of the richness of the Sacramento district that they have their parallel in the history of anterior discoveries of a similar kind.

It must have already occurred to the reader that the productiveness of the new gold region is not the only element in the question we have proposed to consider, and that the amount of gold already actually, or potentially, existing in bullion, coin, plate, and in the old mines and washings, forms equally a most important item of the account.

The Emperor of Russia has for years employed some of the most eminent scientific men in Europe to assist in developing the resources and capabilities of the Ural placit. For ages the sands of Africa have yielded a yearly abundant tribute of gold. Europe has furnished her contingent from the mines of Hungary, and Central and South America have now for more than three centuries contributed the produce of their vast and rich mines. It would be trifling with the subject to attempt to pronounce, in the absence of any positive data, an opinion on the gross produce from these sources, since there is really very little known of the yield of any one of them. We have reason, however, to believe that the quantity of fresh gold brought annually into ths market to supply the loss by wear and tear, and to satisfy the growing demand, amounts to £24,000,000 in value. Supposing, therefore, that as much gold will be obtained from the Sierra Nevada, in California, as is now produced by the Ural placit (£3,000,000 annually), it is quite obvious that this would have no very sensible effect on the market value of the article. And here we may be permitted to correct a mistake into which many have fallen in speaking on this subject. It has been supposed by some that the law of value is influenced in a direct ratio by the relation between demand and supply; thus, for instance, that an addition of one eighth to the supply of an article would diminish the price of that article in the same proportion. This is a misapprehension of the subject. The value, or rather the price, of articles, indeed, rises or falls with the abundance or deficiency of the demand for, or supply of, that article, but the extent of the rise or fall is altogether independent of the existing relation between demand and supply, and simply proportionate to the *relative* extent of the deficiency or abundance.*

A proper consideration and appreciation of this fact, which we have not sufficient space to illustrate more fully, leads to the conclusion that even a much larger increase than we have supposed might take place,—that, instead of three, six millions might be furnished by the new gold district,—and yet the price of that metal not be sensibly influenced thereby.

There is still another point to be considered of

* "The price of corn in this country has risen from 100 to 200 per cent., when the utmost deficiency of the crops has not been more than one sixth and one third below the average."—*Tooke's History of Prices*, vol. 1, p 13.

very great importance in the calculation. In proportion as wealth has accumulated in civilized states, so has the demand for the precious metals inercased; and so rapid is the accumulation and development of national wealth in our days that the annual addition to the demand is likely to exceed rather than fall short of the additional supply.

Confining our view to the Anglo-Saxon race, the rapid advance of that race in wealth and commercial enterprise bids fair to find plenty of uses, for two or three generations to come, for all the gold and silver that the American mines can be reasonably expected to produce. Viewed in this light, the new mines present themselves to us as the kind gift of Nature to our expanding wants, rather than the capricious lavishness of chance. Since the sixteenth century the amount of circulating medium in the world has increased at least a hundredfold, and is proportionally less likely to be affected by what must now be considered minute additions. Nor need we fear that the progress of society in civilization and refinement will come to a stop; on the contrary, the scientific discoveries which have been made during this, the first and now closing half of the present, century are a pledge that the increase of mineral wealth will proceed with even more rapid strides. We firmly believe industry will receive a fresh impulse, commerce be facilitated, and art promoted by the discovery of these Californian mines; while, on the other hand, we entertain no apprehension that any violent changes or real injury to any human interest whatsoever will ensue from this discovery.

MR. SIEMINS' IMPROVED AIR-PUMP.

The improvements which have been effected in the pneumatic machine since the days of its illustrious inventor, Otto von Guericke, have been confined almost exclusively to matters of detail; the principle and the essential components of the machine remain substantially the same still as they were at the time of its invention.

Mr. C. W. Siemins has recently taken out a patent for the construction of an improved air-pump, which contains a perfectly novel feature. This new engine consists essentially of two cylinders of different size: the smaller of these cylinders is affixed either to the top or to the bottom of the larger one, and the valved pistons of the two are attached to the same rod. The air withdrawn from the receiver, or other vessel intended to be exhausted, is condensed in the lower cylinder into one fourth part of its original volume, by which means it is endowed with sufficient elasticity to counteract the opposing pressure of the atmosphere on the discharging valve, and consequently to escape through that valve.

The annexed engraving (Fig. 1) presents a sectional view of the instrument.

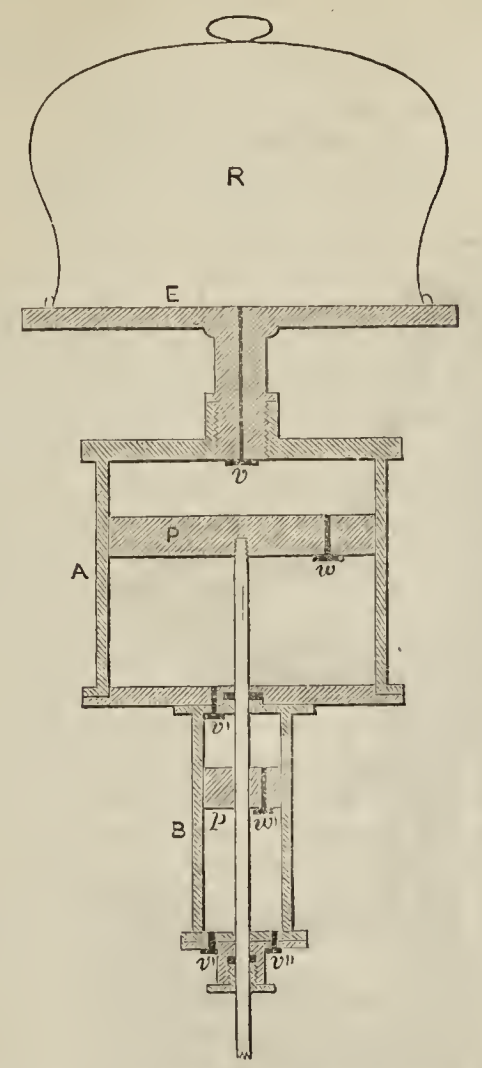
A is the exhausting cylinder.

B represents a second cylinder, equal in length to *A*, to the bottom of which (in the form of the instrument here represented) it is fixed, but having only one third or one fourth of its sectional area, and, accordingly, only one third or one fourth of its cubical capacity.

The two cylinders are separated by a plate forming at once the bottom of the upper and the top of the lower cylinder, the only air-passage between them being a silk valve *v'*.

In each cylinder works a valved piston *P* and *p* attached to a piston-rod common to both, which passes through a stuffing-box in the plate.

Fig. 1.



The distance between the pistons is such that, when *P* is in contact with the top of the upper or exhausting cylinder, *p* is in contact with the top of the smaller or lower cylinder; and, when *P* is in contact with the bottom of the larger, *p* is in contact with that of the smaller, cylinder. The pump-plate *E* placed above the large cylinder *A* supports the receiver *R*, or other vessel intended to be exhausted, from which the air flows through the valve *v* during the descent of the piston *P*.

Fig. 2 represents the complete pump, as manufactured for philosophical purposes. The motion of the pistons is effected by means of a short crank with a jointed connecting rod, converting the circular motion given by the lever handle into a vertical one, which is maintained by means of a cross head, with rollers working between guides.

The action of this air-pump is as follows:—

On the descent of the piston *P* tending to produce a vacuum in the exhausting cylinder *A* by causing a difference of pressure above and below the first valve *v* in the top of the cylinder, the elasticity of the air in the receiver causes it to pass through the valve *v*. The air below the piston *P* is at the same time pressed through the valve *v'* in the plate separating the cylinders, and enters the cylinder *B*, in which a vacancy is simultaneously made for it by the descent of the piston *p*, and, in consequence of the difference of capacity of the two cylinders, the air becomes reduced to one fourth of its original bulk, its elasticity, according to the well-known law, being proportionally increased. The air contained in the small cylinder below the piston *p* will in like manner be pressed through the valves *v' v''* into the atmosphere.

During the ascent of the pistons the valves *v v' v''* will be closed, and the valves *w w'* in the pistons opened, by the upward pressure of the air in the cylinders and atmosphere, admitting the air in each cylinder to pass through the pistons as they rise, in order that, in the following downward movement, the air, which during the previous stroke of the pump issued from the receiver into the exhausting cylinder, may be withdrawn from the latter into the lower cylinder, while the air condensed in this latter may be finally expelled into the atmosphere. Mr. Siemins contends that, with an instrument thus constructed, we are enabled to obtain a more perfect vacuum than by any air-pump previously devised.

To prove the correctness of this assertion he says:—Let us compare the action of two air-pumps, one of the improved the other of the usual construction, assuming that they are both equally perfect in workmanship. If an air-pump could discharge the entire quantity of air contained in it at the end of every stroke of the piston, and if the action of the valves were also perfect, there would be nothing to prevent our obtaining a perfect vacuum.* But whoever has tried the experiment will have found that an ordinary philosophical air-pump does not remove much more than $\frac{99}{100}$th of the atmosphere from the receiver, however long he may have continued to work the instrument. We may conclude, therefore, even when the piston is in contact with the bottom of the cylinder, that there still remains a space equal to $\frac{1}{100}$th of the capacity of the cylinder, through which the piston cannot be depressed, and where the air is merely condensed, expanding and refilling the whole cylinder as soon as the piston is raised.

Now, let us suppose that in the new air-pump the piston *P* leaves $\frac{1}{100}$th of the air in the exhausting cylinder *A* undisplaced, and that the piston *p* cannot be brought within $\frac{1}{100}$th part of the length of stroke of the top or bottom of the smaller cylinder, the working having been continued until no further exhaustion is effected. At this period the piston *p* will leave in the cylinder *B*, during the downward stroke, $\frac{1}{100}$th of its bulk of air of the atmospheric density unexhausted; if it be raised again, this portion of air will expand and fill the cylinder *B* with air, the density of which will be only $\frac{1}{100}$th that of the atmosphere. The piston *P* will at the same time ascend to the top of the exausting cylinder *A* filled with air of the same density as that remaining in the receiver; but, the exhaustion having reached its utmost limit, during the next downward stroke no air will be discharged from cylinder *A* into cylinder *B;* the air above the piston in the latter will, at the termination of this stroke, have expanded one hundred times, and, having previously expanded to an equal amount during the upward stroke, it will now be reduced to a density $=\frac{1}{10000}$th that of the atmosphere. If no force were required to open the valve *v'*, air would, in this state of things, pass from the upper into the lower cylinder, unless that in the former, a hundred times compressed as it would be at the end of the downward stroke, were not still rarefied ten thousand times; or, what is the same thing, if it were not, when it filled the cylinder *A*, one million times rarefied. We find, therefore, that by the addition of the second cylinder the vacuum may be rendered ten thousand times more perfect than if the cylinder *A* had been employed alone in the manner of an ordinary air-pump.†

* On this subject Mr. Siemins observes:—"It is the opinion of some natural philosophers that the whole of the air could never be exhausted from a closed vessel by means of a pump, even if the apparatus were theoretically perfect. From that opinion, however, I must beg leave to dissent; for, even if the repulsive force which separates the atoms of fluids were itself unlimited (which, however, has never been proved), there necessarily must be a limit where that force and the force of gravity acting on a single particle just equal each other; and if a vessel were emptied of air to this extent, and a further portion were withdrawn, the remainder would no longer be able to fill the whole vessel, but would cover the bottom only, as a non-elastic fluid would, leaving a perfect vacuum above. In this state of things, continual withdrawals of air from the lower part of the vessel would at length cause the last atom itself to be withdrawn."

† *Cæteris paribus*, if a well-made pump, of any of the ordinary forms, will rarefy the air to $\frac{99}{100}$, the new one would carry the rarefaction up to $\frac{999999}{1000000}$ if the valve *v'* could be rendered automatic. Although the reasoning above is in some degree theoretical, it is independent of the consideration of extreme accuracy in the construction of the new air-pump, which will produce a

Fig. 2.

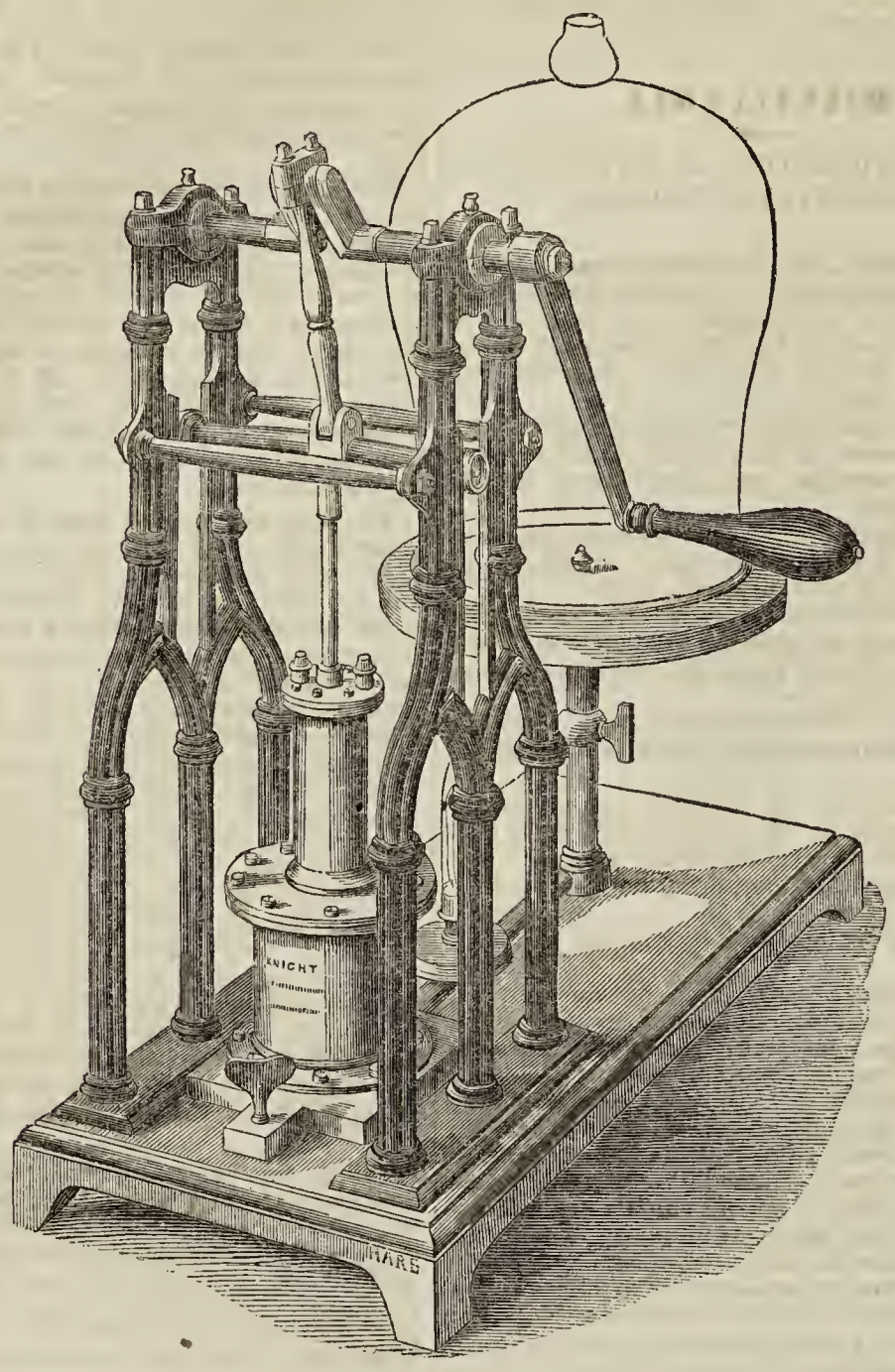
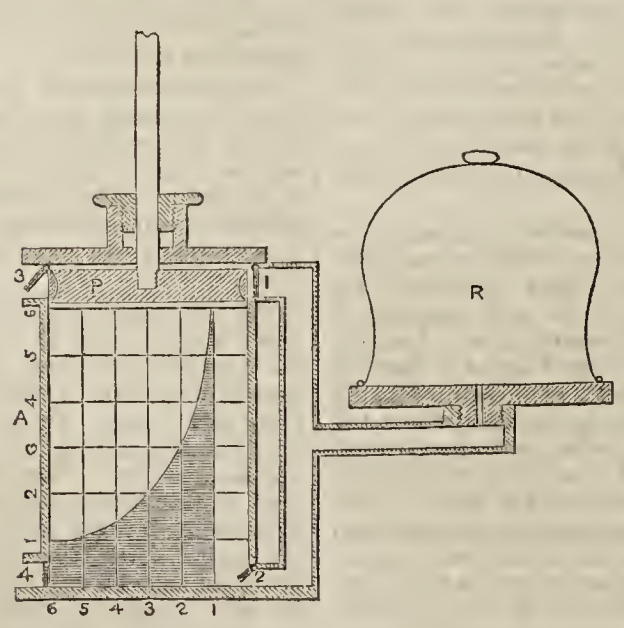


Fig. 3.



As the leakage of the valves and piston is a principal cause of the imperfection of the vacuum obtained by means of air-pumps of the ordinary construction, it may be objected that, as we have in the new one two valves and one piston more than usual, the loss of effect from this cause will be proportionally greater. This, however, is not the case. On the contrary, the loss from leakage at the valves and pistons is diminished in the new air-pump, nearly in the same ratio as the opposing unexhausted space in the cylinder. The amount of leakage through a given aperture bears a certain proportion to the difference of pressure on each side (increasing as the square root of the pressure), and it will be observed that this difference of pressure, especially in the large cylinder, is very small indeed, and occurs at intervals only; whereas, in the case of an ordinary single-acting pump, the entire atmosphere constantly rests on the piston and exhausting valve. Besides, in the new air-pump, the leakage of the air through the apparatus is opposed by a greater number of obstructions, one after another, between the discharging valve and the receiver. Indeed, even the removal of the valve *v*, and the leakiness of any of the other valves, would not considerably impair the efficacy of the pump.

Another circumstance interfering with the power of obtaining a good vacuum by means of a well-made air-pump by any of the forms previously devised, but which is obviated in the new instrument, is, that the valve through which the air has to pass from the receiver into the pump is forced into its seat at the end of the reversed stroke, by the whole pressure of the atmosphere *minus* only that of the air remaining in the receiver. By this the silk valve is soon injured, and, what is even more important, the rarefied air has not power to force it open again, and the exhaustion consequently ceases, before the vacuum has attained that degree of perfection to which it might otherwise be carried. One of the most obvious objections to an ordinary air-pump, whether single or double acting, arises from the inequality of the force required to move the piston through different portions of the stroke, and from the very great force which is ultimately requisite.

In the diagram (Fig. 3) *A* is the barrel of a double-acting air-pump, which, by the alternate motion of the piston *P* and the valves (1) (2) (3) and (4), produces a partial vacuum in the receiver or closed vessel *R*. Let us suppose that $\frac{5}{6}$ths of the air originally contained in *R* have been removed, and that the working of the pump is still continued. The resistance which the piston will now have to encounter is readily found from the law of Mariotte, and is here represented by the shaded part of the diagram, bounded by the parabolic curve. At the commencement of the stroke the pressure on both sides of the piston being equal to $\frac{1}{6}$ atmosphere, the resistance is 0; it increases gradually in proportion to the diminution of the space below the piston until the air has been compressed to $\frac{1}{6}$th of its original volume, when its density will have become equal to that of the atmosphere, and the discharging valve (4) will be opened. It is evident in this case that the force required to move the piston to the bottom of the cylinder must be sufficient to overcome the maximum resistance, which will be about $3\frac{1}{4}$ times greater than the average amount that would be experienced if the entire resistance could be distributed over the whole stroke.

In this illustration we have supposed the pump to be double-acting, and have, therefore, deducted from the actual pressure against the piston the uniform "aiding pressure" of the air which follows it freely from the receiver through the valve (1).

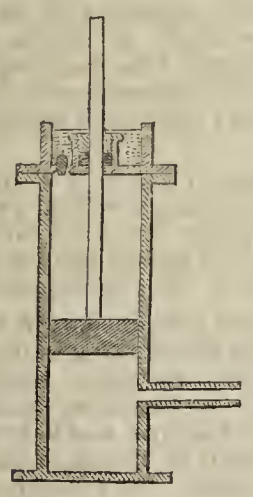
Air-pumps for philosophical purposes are very commonly single-acting, the pressure of the atmosphere being constantly exerted on one side of the piston only; but when there are two cylinders, as is frequently the case, having their piston-rods connected with the opposite ends of the same lever, the atmospheric pressure on one piston balances that on the other, and the resistance will be equivalent to that occurring in a pump with one double-acting cylinder. In a single-barrel pump with open top the inequality of load is still greater than in a double-acting or double-cylinder pump. The inequality of load increases as the rarefaction proceeds, but the resultant of the resistance attains its maximum when the vacuum equals nineteen inches of mercury in the gauge, or when nearly $\frac{2}{3}$rds of the atmosphere have been removed from the receiver, after which it constantly diminishes.

vacuum approaching to the perfection assigned, in proportion to the smallness of the force required to open the valve *v'*.

It will readily be perceived that in the improved air-pump this great inequality of load does not exist, and, therefore, a pump of several times greater capacity than any given one on the ordinary construction may be worked with equal facility and speed, because the resisting pressure against the larger piston *P* cannot rise at the termination of the stroke to more than four times the pressure of the air still contained in the receiver, and therefore diminishes as the perfection of the vacuum increases; and even of this greatest resisting pressure one fourth part is balanced by the pressure on the top of the piston of the air entering the cylinder from the receiver, and another fourth by the increasing "aiding pressure" on the top of the small piston *p*; and the remaining half, after a tolerable vacuum has been formed, may be almost entirely neglected. The greatest resistance to the action of the small piston is that of the atmosphere, and is equal, therefore, to the greatest resistance in an ordinary air-pump, but it must be recollected that its area is only one fourth of the area of the exhausting cylinder.

One modification, however, of the single-barrel pump is in a great degree free from the objections which have been urged above. (See Fig. 4.) In it the atmosphere is entirely ex-

Fig. 4.



cluded, the piston in its motion passing an opening through which the air issues from the receiver, and is then discharged by a valve into a vessel filled with oil. Pumps of this construction can be rendered very perfect, but they are liable to grave personal objections, though of a different nature from those applying to the forms previously described. They require more power for working than any other kind of air-pump, because the air which follows the piston in its upward course has to be impelled backward bodily into the receiver, until it again passes the aperture, when it returns to fill the cylinder. Another objection to its general use arises from the circumstance that it requires to be moved slowly, and to receive much attention during the working.

By the double-cylinder air-pump now submitted to the public a very perfect vacuum may be obtained, even if the stroke is short, and the pistons do not touch the bottoms of the cylinders; considerable practical advantage is also realized by the application of a crank to give motion to the pistons. To this may be added the consequent greater ease and speed of working, attended with less racking of the entire apparatus, and less injury to the valves than in any form of air-pump previously constructed.

Finally, as to the cost, if the perfection of the instrument be taken into consideration a great saving will be obtained.

The manufacturers have taken considerable pains to reduce the cost, as far as possible: this has been the principal cause of delay in bringing this air-pump before the public, and they are prepared to supply the patent air-pump of the form represented in Fig. 1, the lower, or exhausting, cylinder of which is three inches in diameter, for £21.

Mr. Siemins' new pneumatic machine is unquestionably a very great improvement upon the air-pumps hitherto in use. The price is most reasonable, and the patentee is deserving of every encouragement and success.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

John Bethell, of Parliament-street, Westminster, gentleman, for improvements in preserving animal and vegetable substances, and also stone, chalk, and plaster, from decay. Patent dated August 21st, 1848. Enrolled February 21st, 1849.

This invention relates to improvements in the mode of preserving from decay animal and vegetable substances, and also divers porous mineral bodies.

The antiseptics which the patentee proposes to employ for wood, animal matters intended for manure, and porous materials, are:—

1. The bituminous or tarry oils obtained by the distillation of either bituminous tar, shale, or bituminous sand, stone, &c. Of these he prefers the following:—

a. The oils obtained by the distillation of tar, and more particularly the heavy oil of coal-gas tar.

b. Pitch, or tar oil, manufactured under the patent granted to Mr. Samuel Cliff, dated December, 1846; this substance may be used either alone or mixed with tar, or bituminous or resinous oils.

c. A fatty oil obtained by the distillation of resin.

d. The native petroleum, or mineral oil, formed in some coal mines, or exuding from certain bituminous rocks, or the oils obtained by the distillation of this native mineral tar.

These oils may be used separately, or a mixture of two or more of them (in any proportions) may be resorted to.

2. Melted resin, thinned, if necessary, by the admixture of any of the oils enumerated sub. 1.

3. The crude pyroligneous acid obtained by the destructive distillation of wood.

4. The crude pyro-acetate (pyrolignate) of copper which is produced by steeping sheets of old copper in pyroligneous acid, or by mixing a solution of sulphate of copper with one of pyrolignate of lime.

5. Sulphur dissolved in either of the oils enumerated sub. 1, in the proportion of one pound of sulphur per gallon of oil. In cases where the antiseptic is intended to serve as a protection against the seaworm, the patentee recommends to dissolve the sulphur in the heavy oil of gas-tar in preference to any of the other oils.

6. A strong solution of bark, the bark of larch or oak being preferred.

The wood which it is desired to preserve is usually first dried and seasoned, or smoked. This is effected in a close brick chamber, of a capacity adapted to the bulk and quantity of the timber stuff to be operated upon; beneath the floor of this chamber the flues of a furnace circulate. The upper surface of these flues being perforated, the heat and smoke escape into the chamber, raising the temperature of the latter to between 100° and 200° F., which is sufficiently high to expel all moisture from the wood. The upper part or roof of the chamber is furnished with a channel placed in connection with an exhausting apparatus, by which the whole products of combustion are drawn off, carrying away with them the vapours evolved from the wood. In order to maintain the proper temperature of the chamber, and prevent its being raised above the requisite degree, the flue has a valved opening over the part where it enters the chamber. The wood is thus not only subjected to the heat requisite for the drying, but is also acted upon by the smoke and gases given off from the fuel (coke, wood, or coal) in the furnace.

The patentee proposes also in certain cases to introduce into the furnace peat and other similar sorts of fuel (which will give off a considerable amount of gas or smoke) in large quantities, so as to deaden the flame, causing thereby the products of combustion to pass in a great measure unconsumed into the chamber; or, instead of this, he proposes to run into the furnace numerous small streams of coal-tar or heated coal-pitch.

Instead of heating the drying chamber by the products of a furnace the patentee introduces air-steam, dried or heated to from 100° to 500°; the heating may be readily effected by passing the steam through red-hot tubes, as is done in the heating of the air for the hot blast in smelting iron. This high-pressure steam is first transmitted through either of the antiseptic materials enumerated sub. 1 and 5, which it absorbs to a considerable extent, and with which it impregnates subsequently the wood in the drying chamber.

The dried and smoked wood is now to be saturated with one of the appropriate antiseptics. If the wood is required simply for uses which will not entail upon it the liability of exposure to the action of the weather, a simple steeping in any of the antiseptics enumerated sub. 3, 4, and 6 will suffice; in cases of this kind the preliminary process of drying and smoking may even be altogether omitted. But for the preservation of wood intended to stand the action of the weather the antiseptics enumerated sub. 1 and 5 answer, but the latter more particularly where the wood has to be protected from the attack of seaworms. The impregnation in such cases is effected best in the common pressure tanks (patented in 1839); the antiseptic is heated to 160° F. (which may be effected by passing steam through it), and subsequently pumped into the tank, under a pressure of 160 lbs. on the square inch, the air having previously been extracted from the tank. To impregnate wood properly which has not been previously smoked or dried the antiseptic should be heated to 200° F.

To preserve animal matters intended for manure, such as fish-bones, the blubber of whales, and other similar matters, the patentee proposes to steep them in any of the antiseptics enumerated sub. 1, 2, 3, 4, and 5, preferring 1 *a* and *b* for small, and 4 and 5 for large, pieces. After the immersion the matters are to be placed in the drying chamber, heated to 160° F. They are thus reduced to dryness, in which state they keep without suffering decomposition. When the time has come to apply this dry manure it is mixed with earth or lime, in the same way as is done with guano.

To preserve porous stones, articles of chalk, plaster of paris, &c., the patentee heats the article and steeps it hot in either of the antiseptics enumerated sub. 1 and 2; after twelve or fourteen hours' immersion he removes the article and dries it in the drying chamber. A coat of paint will serve as an additional protection.

For the preserving of meat the patentee employs a mixture of wood naphtha and water, in the proportion of one gallon of the former to four gallons of the latter. This mixture he saturates with salt to about the same extent as a brine used in salting meat. Where the meat is not required to be kept for any great length of time, nor in large quantities, he kills the animal by stabbing it in the heart, and afterwards injects the naphtha into the veins through one of the principal arteries in connection with that organ. By this means the meat becomes slightly impregnated with salt, but it may be cooked as fresh meat; in this condition it will keep for a considerable time. But where the meat is required for long voyages it is necessary to salt it subsequently with the solution, in the ordinary manner, which will not, however, render it so hard as usual. Meat impregnated in this way may also be preserved by cutting it into thin slices, drying it subsequently by means of heated air or steam, and packing it finally in close cases,

eharged with carbonie acid gas, at a density of 20 or 30 lbs. to the square ineh.

Another part of the invention relates to the preserving of wines and malt liquors, which the patentee effects by placing them in close cases, leaving a space above the liquid, into which he forces carbonic acid gas, at a density of from 60 to 80 lbs. on the square inch.

Milk and cream are preserved in a somewhat similar manner, with this difference, that the milk is charged with the carbonic acid gas, in the same way as is done in the manufacture of soda-water, omitting simply the agitator in the machine. The milk is then drawn off and bottled, or received in close cases.

Another part of the specification relates to a machine intended to be used for drying corn and other kinds of grain. This machine consists simply of a case in which are a number of endless webs placed horizontally one above the other; each of these webs is stretched on two rollers, the axles of which, being geared by means of pinions, cause each alternate web to travel in opposite directions, so that the grain which is supplied to the uppermost web from a hopper at the top is carried slowly backwards and forwards, as it falls from one web to the other, till it is finally delivered at the bottom. Dried steam or heated air is admitted at the bottom of the machine; this, ascending through the web and other interstices, effectually absorbs the moisture from the grain; the heat employed must not exceed 170°. An opening is made at the top for the escape of the vapours, and another channel is provided fer the admission of cold air, which is situated as near as possible to the hot air or steam passage, and by which the temperature of the machine can be readily regulated.

Having thus described the nature of his invention, the patentee desires to elaim:—

First. The mode of drying and seasoning or smoking wood as described. He also claims the use of dried or heated steam for the drying and preserving of wood, corn, and grain of all sorts, and for which purpose he prefers using the machine before described; but the dried or heated steam may be used in several other modes, as stated in the eourse of the specification.

Seeondly. He elaims the preserving wood by saturating it with either of the antiseptics enumerated sub. 1, *a*, *b*, *c*, *d*, and 2, 3, 4, and 5, and according to any of the described modes, or by any other means by which the saturation may be effected; but he disclaims the use of any of the antiseptics sub. 1, *a* and *b*, for wood, excepting only when used in combination with the modes of saturation described, in which case he claims these also.

Thirdly. He claims the drying and preserving corn and grain as described; and also the machine or apparatus described for drying corn and grain of all kinds; and, further, he claims as his invention the preserving meat for food, and the preserving of animal matters intended for manure.

Fourthly. He claims the preserving of milk by impregnating or charging it with carbonic acid gas, and the keeping milk so treated in close barrels or other vessels, as described.

Fifthly. He claims the preserving of malt liquors and wines by impregnating or charging them with carbonic acid gas in close vessels, as described.

Lastly. He claims the preserving of porous materials, such as stones, chalk, plaster, &c., as described.

William Wheldon, engineer to Messrs. John Warner and Sons, of Jewin-crescent, in the city of London, brassfounders and engineers, for improvements in pumps or machinery for raising or forcing fluids. Patent dated September 4th, 1848. Enrolled March 3d, 1849.

The invention relates to that class of pumps which are worked by lever-handles; the improvements consist in causing the axes of such lever-handles to be carried by vibrating or rocking standards, which standards move on axes below the axes of the lever-handles. Various descriptions of lift and force pumps, with this improvement attached to them, are represented in the drawings which accompany the specification. The objeet of the improvement is to maintain the parallelism of the pump-rod.

The rocking standard, forming the fulcrum on which the pump-handle moves, is pivoted on the side or top of the pump, and carried up to a sufficient height to obtain the required movement of the pump-bucket or piston, the fulcrum of the lever-handle being at the top. In the various modifications it is adapted to the divers purposes to which it may be applied, as in the beer-engine, where it assumes the form of a bell-crank, the handle part being in a vertical position, the fulcrum on which it moves advancing to, and receding from, the line of the pump-rod, according to the position or angle it takes with regard to the pump-rod.

Having described the nature of his invention, the patentee would have it understood that he makes no claim to the mechanical parts separately; but what he claims is, the mounting of the axes of the lever-handles for pumps on the upper parts of vibrating or rocking standards, the vibrating or rocking standards having their axes of motion below the axes of motion of the lever pump-handles.

Richard Laming, of Chichy la Garonne, near Paris, in the Republic of France, chemist, for improvements in the modes of obtaining or manufacturing sulphuric acid and sulphur. Patent dated September 4th, 1848. Enrolled March 3d, 1849.

The first part of this specification relates to the manufacture of sulphuric acid with the aid of pumice-stone, or other similar cheap porous bodies, acting as catalytics. The patentee wishes it to be distinetly understood that he does not claim as original the use of bodies acting by catalysis—platinum having been previously used for such purposes; but he elaims as new the use of pumice-stone or other eheap porous bodies in conjunction with ammonia. He prepares the catalytic substance as follows:—He boils the pumice-stone, &c., in concentrated sulphuric acid; after draining off the acid he immerses the stone in water containing about twenty per cent. of ammonia; he places the substance now in a retort, together with about one per cent. of peroxide of manganese, and heats to 600° Fahr.; he then removes the fire and allows the substance to cool gradually, without admitting atmospheric air to it. This is the process which the patentee prefers, but he states at the same time that certain modifications may be made in it: thus, for instance, the pumice-stone or other catalytic agent may be first boiled in concentrated sulphuric acid, and immersed afterwards in nitric acid, or in a solution of an alkaline nitrate; or it may be either boiled or simply immersed in a mixture of sulphuric and nitric acids.

The improvements in the manufacture of the acid consist in the mode of exposing the catalytic agent, prepared in the manner just now described, to a current of sulphurous acid gas and atmospheric air. A small quantity of aqueous vapour and ammonia (1 part of ammoniacal gas to every 1,000 parts of concentrated sulphurie acid intended to be produced) is employed to heighten the energy of the catalytic agent.

The apparatus which the patentee uses consists of a cylindrical vessel, placed vertically, and divided vertically by moveable slides into four equal chambers; a pipe passes into the lower part of the bottom chamber; another pipe brings the sulphurous gas, mixed with a due proportion of atmospherie air, from the sulphur-furnace; the gaseous mixture, after passing through the two middle compartments, previously filled with the prepared catalytie substance, flows out by a pipe to the next part of the apparatus; a small pipe communicates with a conduit, and opens at the other end to a small cistern, which must be supplied with ammonia and water—the flow to be regulated by a stopcock. The conduit-pipes terminate in jackets, passing round the magazine, which is, at that part, perforated with small holes, for the free passage of the gases, but not sufficiently large for the escape of the catalytic substance. The magazine, as before described, is divided into four compartments for facilitating the working of the apparatus. The top is furnished with an air-tight cap or cover; the two middle compartments communicate with each other (in so far as the passage of the gas is concerned), by means of perforations in the slide between them, while the top and bottom slides, when closed, stop the communication between the upper and lower compartments and the two central ones. Thus, when it is required to recharge the magazine, the catalytic substance therein being exhausted, the cap must be removed, the upper chamber filled with fresh material, and the cover replaced. If the lower slide be now withdrawn, the chamber above it will be emptied of the solid matter, the quantity of exhausted catalytie substance being at the same time registered; the lowest slide must be again closed, and the middle and top slide successively opened and closed, which will refill the two central chambers; the apparatus may be thus recharged as often as may be required without admitting the atmosphere or in any way stopping the process. The gases, after passing in this manner through the magazine charged with the prepared catalytie substance, flow through an upper pipe, and then through a series of pipes arranged in the follwing manner:—Forty-four large cylindrical vessels are placed in successive rows, vertically, eaeh standing in a water-tight joint, upon the lid of a cistern; each tube opens into the cistern beneath by a short pipe; each pair of tubes is also connected by a branch-pipe at the top, thus forming twenty-two syphons, standing upon, and communicating with, the cistern beneath; the cistern itself is divided directly under the centre of each syphon thus formed by partitions fixed to the cover and sides, and deseending about halfway down to the bottom of the cistern, and below the surface of the water eontained therein; it will be seen that an uninterrupted passage through all the tubes is thus effected, the cistern forming a part of this passage. The tubes are built in pieces, fitting one on the other by means of water-tight joints; the interior of these tubes is fitted up with shelves of a crescent form, of full three parts of the area of the tubes, the opening being left on alternate sides of the cylinder; these shelves or trays receive a layer of the prepared catalytic substance before described. The magazine being charged, and that portion of it through which the gases pass from the sulphur-furnace, heated by a flue, furnace, or other suitable means to about 600° Fahr., the vapours pass from the conduit-pipe, in the upper part of the magazine, to the first compartment of the cistern; from thence through the first syphon into the second part of the cistern, on to the next syphon, and so on through the series, into the last compartment of the cistern; from this part a pipe communicates with a leaden chamber, conveniently placed, for the condensation of the gas. This chamber is also furnished with an opening in the lid into a chimney or shaft, in order that a sufficient draught may be kept up through the whole series of tubes for the efficient working of the apparatus. The upper joints of the tubes are regularly supplied with a certain determined quantity of water by stopcocks, which, overflowing, falls over the catalytie substance, from tray to tray, until it arrives at the bottom joints, thence falling into the eistern beneath, a small portion passing off in the form of vapour with the other heated gases. As the sulphuric acid contained in the cistern is most concentrated where the gases first enter from the magazine, the exit-pipe, through which the acid reaches the receiver, is placed at that point, and near to the bottom of the cistern and tubes, thus preventing the acid, from the further end of the eistern, from prematurely arriving in its less eoncentrated state at the exit-pipe. Partitions are fixed to

the bottom and sides of the cistern, extending some distance upwards, so that the sulphuric acid can only reach the exit-pipe by overflowing the several partitions. The cistern is made of wood, lined with lead, and the tubes may be also made of the latter material; but the patentee prefers them to be made of earthenware, as a cheaper substance, and not so liable to corrosion as the metal, though, in this case, it would be advisable to have the first two or three tubes from the magazine made of lead, on account of the great heat imparted from the gases on first entering the apparatus, and the tubes being less subject to sudden atmospheric changes when made of metal; or the same object might be attained by having the first tube of much larger dimensions than the rest. In the apparatus described the tubes are forty-four in number, two feet in diameter, and ten feet high, and, providing the sulphur-furnace be of good construction, will produce 22 cwt. of concentrated sulphuric acid per day, consuming about $7\frac{1}{4}$ cwt. of sulphur. In practice it will be found most convenient to have the tubes, with the cistern at their base, on the first floor of a building, and the sulphur-furnace and receiving-vessel for the acid on the ground floor, as the acid can then flow down in its most concentrated state into the receiving-vessel.

Another improved process of obtaining concentrated sulphuric acid is conducted as follows:— Instead of the ordinary platinum still, a eylindrical vessel is constructed of earthenware (tubes of that nature joined one on to the other with fire-clay). The interior of this cylindrical vessel is filled with a number of earthenware or porcelain diaphragms of the diameter of the interior of the tube, and resting on ledges; through the centres of these diaphragms circular holes are cut; on eaeh diaphragm thus placed is a flat circular table of larger diameter than the holes in the diaphragms, but somewhat smaller than the interior of the tube; these flat discs or tables stand upon the plates by means of a suitable number of legs. Both the discs and diaphragms are made with ledges in a manner that they may contain about an inch in depth of acid. The top of the pipe or conduit is dome-shaped; a syphon-tube passes through it for supplying the weak sulphurie acid, which is delivered upon the uppermost table; this, overflowing, discharges it upon the diaphragm beneath; the acid thus gradually falls from table to diaphragm, and from diaphragm to table, until it reaches the bottom of the tube, whence it passes through a platinum syphon to a proper receiver. A tube passes up into the bottom of the apparatus for the passage of heated air or gas, which escapes finally through a chimney in the dome. It may be stated here that it is necessary to surround the whole tube with masonry or some other good non-conductor of caloric. Instead of passing heated air or gas through the apparatus, it might be surrounded with sand contained in a large iron cylinder, and heated by means of a flue or furnace applied to the latter. This apparatus might also be applied when it is desired to concentrate the sulphuric acid by the use of nitrie acid; in this case the magazine must be suppressed; the gases are carried from the sulphur-furnace into the apparatus through the pipe which, in the process just now described, serves to effect the admission of heated air; after passing up over the successive layers of sulphuric acid on the tables and diaphragms, the gas may flow out at the dome-shaped top into the cistern, and through the series of tubes described in the first part of the invention. The nitrie acid may be introduced in the ordinary manner, only that a much less quantity would be requisite, owing to the resistance offered to the escape of the carbonic oxide during the process of manufacture.

Another part of this invention relates to a new mode of obtaining sulphur from the ammoniacal liquor of gasworks. When the ammoniaeal liquor of gasworks is saturated with a mineral acid, as is practised for obtaining sulphate and muriate of ammonia, great quantities of sulphuretted hydrogen are given forth; attempts have been made to make use of this sulphuretted hydrogen in lieu of solid sulphur in the manufacture of sulphuric acid, but these attempts have always been attended with failure hitherto, on account of the immense quantity of incombustible carbonic acid gas mixed with the sulphuretted hydrogen. The patentee proposes utilizing this source of sulphur by adding the mineral acid to the ammoniacal liquor in a close wooden vessel, and receiving the sulphuretted hydrogen and carbonic acid gas given forth in a close wooden vessel containing sulphuric acid; the two latter substances are reagents, mutually decomposing each other with the production of sulphur, which may be drawn off with the liquid, from which it will then speedily subside. To prevent the sulphuric acid being lost by passing off with the carbonic acid gas, it is made to pass through a wooden tube containing shelves of sawdust, kept wet by a constant flow of water downwards through the tube. The sulphurous acid thus obtained may be used over again.

The claims are:—

First. The use of pumice-stone or some similar cheap porous substance acting as a eatalytic in the manufacture of concentrated sulphuric acid. The patentee employs ammonia to heighten the energy of the action of catalytic agents.

Secondly. The mode of passing thin layers of acid gradually over a series of plates, each successive plate being of a greater heat than that which precedes it, as the acid itself becomes more highly concentrated. He claims also the use of the stoneware or porcelain apparatus described.

Thirdly. The patentee elaims the process deseribed for procuring sulphur from the ammoniacal liquor of gasworks; but he wishes it to be understood that he does not claim any isolated part of the process.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MARCH 14TH, 1849.

Andrew Shanks, of Robert-street, Adelphi, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. Patent dated March 14th, 1849; six months.

John Smith, of Hare, Craig, Dundee, factor to Lord Douglas, of Douglas, for improvements in the manufaeture of flour, applicable to the making of bread, biscuits, and pastry. Patent dated March 14th, 1849; six months.

Robert Ross Rowan Moore, of the Temple, barrister-at-law, for improvements in the manufacture of letters and figures to be applied to shop-fronts and other surfaces. Patent dated Mareh 14th, 1849; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in the manufacture of candles and night lights. Patent dated March 14th, 1849; six months.

James Williamson Brooke, of Camden-town, gentleman, for improvements in lamps. Patent dated March 14th, 1849; six months.

Thomas Clarke, of Hackney, in the county of Middlesex, engineer, and Thomas Motley, of the eity of Bristol, civil engineer, for certain improvements in obtaining and applying motive power; also improvements in railroads, and other roads, and in supporting pressure, resisting strain, and protecting against fire. Patent dated March 14th, 1849; six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. Patent dated March 14th, 1849; six months.

William Payne, of New Bond-street, watch and pedometer maker, for certain improvements in elocks and watehes. Patent dated March 14th, 1849; six months.

Alexander Swan, of Kircaldy, in the county of Fife, manufacturer, for improvements in heating apparatus, and in applying hot air to manufacturing and other purposes where the same is required. Patent dated March 14th, 1849; six months.

William Gratrix, of Salford, in the county of Lancaster, bleacher and dyer, for certain improvements in the method or process of drying and finishing woven and other fabrics, and in the machinery or apparatus for performing the same, part of which improvements are applicable to stretching woven fabrics. Patent dated March 14th, 1849; six months.

Ignacio de Berres, of Lisbon, but now residing in Paris, gentleman, for improvements in machinery for making lasts for boots and shoes, butts or stocks for firearms, and other irregular forms. Patent dated March 14th, 1849; six months.

Allen Bragg, of Queen's-row, Pentonville, bath-keeper, for improvements in propelling by atmospheric pressure. Patent dated March 14th, 1849; six months.

Francis Hay Thomson, of Hope-street, Glasgow, doctor of medicine, for an improvement or improvements in smelting copper or other ores. Patent dated March 14th, 1849; six months.

Pierre Augustin Chauffourier, of Regent's-quadrant, merchant, for certain improvements in the manufacture of watches. Patent dated March 14th, 1849; six months. (Communication.)

Peter Armand Lecomte de Fontain Moreau, of South-street, Finsbury, London, for certain improvements in coating or covering metallic and non-metallic bodies. Patent dated March 14th, 1849; six months. (Communication.)

PATENTS RECENTLY EXPIRED.

H. Hendricks, Blackheath, Esq., for improvements in dyeing. Patent dated March 11th, 1835; expired March 11th, 1849.

J. B. Bacon, Middlesex, for improvements in the construction of locomotive steam-carriages, applicable to railways and eommon roads. Patent dated March 11th, 1835; expired March 11th, 1849. (Communication.)

W. Hale, Colchester, civil engineer, for certain improvements on, or additions to, boilers, or apparatus for promoting motive power. Patent dated March 11th, 1835; expired March 11th, 1849.

W. Newton, Middlesex, engineer, for a method of preparing animal milk, and bringing it into such a state as shall allow of its being preserved for any length of time with its nutritive properties, and capable of being transported to any climate, for domestic or medicinal uses. Patent dated March 11th, 1835; expired March 11th, 1849.

R. Jupe, Middlesex, upholsterer, for an improved expanding table. Patent dated March 11th, 1835; expired March 11th, 1849.

J. Sylvester, Middlesex, civil engineer, for improvements in apparatus used in the communication or transmission of heat to aëriform liquid and solid bodies. Patent dated March 11th, 1835; expired March 11th, 1849.

W. B. Adams, Middlesex, coachmaker, for an improved construction of wheels for all kinds of carriages in which springs are commonly used. Patent dated March 13th, 1835; expired March 13th, 1849.

W. Church, Birmingham, for certain improvements in apparatus to be employed in the conveyance of goods and passengers by land or water, parts of which said improvements are also applicable to the ordinary purposes of steam-engines, and other steam apparatus. Patent dated March 16th, 1835; expired March 16th, 1849.

HOPS, MALT, AND BREWERS.—The usual accounts relative to hops, malt, and brewers, have been laid before the House of Commons, on the motion of Mr. Alderman Humphery, M.P. The total number of acres of land in Great Britain under the cultivation of hops amounted last year to $49{,}232\frac{1}{2}$. The duty on hops of the growth of the year 1848 amounted altogether to the sum of £388,007, of which £212,481 was at the old duty of 1d. and 12-20ths per lb., £157,051 at the new duty of $\frac{3}{4}$d. and 8-20ths per lb., and £18,473 at

the additional duty of 5 per cent. The total quantity of hops exported from Great Britain to foreign countries last year amounted to 357,029lb. The quantity of foreign hops imported into the United Kingdom in 1848 amounted to 385 cwt. (from Holland, Turkey, and the United States of North America). The total quantity of hops charged with duty in the several collections of the United Kingdom in the year 1848 amounted to 44,343,985lb. We now proceed to the malt department. The total quantity of malt made in the year ended October 10, 1848, amounted to 4,913,004 quarters, of which 3,321,014 were by brewers and victuallers, and 378,757 by retail brewers. The quantity of beer and ale, in barrels and bottles, exported during the same period was 134,798. The total number of brewers in England amounts to 2,196; the number of victuallers to 58,986, of whom 34,062 are licensed to sell beer to be drunk on the premises. The number of victuallers who brew their own beer amounts to 25,627. The quantity of malt consumed by brewers is 17,219,390 bushels, and by victuallers 7,194,379 bushels.

THE CHOLERA.

—	No. of Cases.	Deaths.	Recoveries.	Under treatment, or result not stated.
Cases already reported:—				
In London and vicinity...	1205	617	136	452
In the country	1077	476	176	425
In Scotland	12040	5219	4230	2591
Total	14322	6312	4542	3468

Fresh cases reported on the 21st of March, 1849: — In London and vicinity, viz.: — St. George in the East Workhouse — number of cases, 1; death, 1. West Ham—number of cases, 2.

In the country, viz.:—Sunderland—number of cases, 3; death, 1.

In Scotland, viz.:—Glasgow—recoveries, 8. Greenock—number of cases, 2; deaths, 3; recoveries, 2. Campbelton Ardersier—number of cases, 2; deaths, 2. Kilbirnie—recovery, 1.

Total new cases, 10; deaths, 7; recoveries, 11.

BIRTHS AND DEATHS DURING THE WEEK ENDING THE 17TH INST.

The Registrar-General's report for the week ending Saturday last shows the number of deaths to be for the week 1,083—less by 86 than the average of the season. The return, therefore, indicates improvement in the public health, though the total number of deaths exceeds the previous week by 36. Mortality from epidemics continues to decline. The deaths registered from cholera were only 9, as follows:—

ST. GEORGE'S, HANOVER-SQUARE: Belgrave.—F. 7, "bilious cholera (24 days); health delicate from birth."

ST. GEORGE'S-IN-THE-EAST; St. John's.—In the workhouse, a labourer, 63, "cholera;" in the workhouse, widow of a mariner, 66, "cholera."

POPLAR; Poplar.—M. 61, "Asiatic cholera (30 hours)."

ST. SAVIOUR; St. Saviour.—In Guy's Hospital, M. 35, "cholera."

ST. GEORGE'S, SOUTHWARK; London-road.—F. 50, "cholera (15 hours)."

LAMBETH; Church, 2d part.—M. 12, "cholera biliosa (10 days)."

CAMBERWELL; Camberwell.—At 15, Queen's-row, Grove-lane, a gentleman, 73, "dyspepsia, English cholera (3 days); exhaustion."

ROTHERHITHE; Rotherhithe.—F. 19, "Asiatic cholera (6 days)."

The total number of births during the same week was 1,521.

METROPOLITAN SEWAGE MANURE COMPANY.—The works of this company at Stanley-bridge, Fulham, are now completed, and are well worth a visit from all who are interested in the progress of agriculture. The company, it will be remembered, was incorporated by act of Parliament, for the purpose of conveying the contents of the London sewers in a liquid form into the country, and distributing them over the fields and gardens which surround the metropolis at a trifling cost. The mechanical means by which these objects are effected are very nearly the same as those by which water is carried into all our large cities, reservoirs being formed for the reception of the sewage, an engine being constructed to pump up as much of it as may be required, and pipes being laid down from the works into the districts where this species of manure is likely to be in demand. The plan has been already tried, it appears, with great success near Glasgow and Manchester, but of course on a small scale compared with the operations contemplated by this company. They have already laid down about nine miles of pipes in the parish of Fulham, and thence they intend extending them without loss of time into the district of Isleworth. The estimates of profit formed by them show that they calculate on supplying sewage to 30,000 acres of land, and that farmers, market-gardeners, and landowners cultivating about 68,000 acres, have by petition to Parliament expressed their interest in the success of the experiment. This reveals the extent of the scheme in which the company have embarked, and its great importance to the interests of agriculture, not only in the neighbourhood of the metropolis and other large towns, but generally throughout the country. Some of the greatest difficulties with which farmers have hitherto had to contend are the scarcity of manure, its inferior quality, and the immense expense incurred in its purchase and transport. The Metropolitan Sewage Manure Company proposes to relieve the cultivators of the soil in the neighbourhood of London from this heavy burden, and if they succeed they will have conferred an inestimable boon upon the agricultural interest, besides turning to good account the sewage which now contaminates the water of the Thames and poisons the atmosphere around it. As to the value of sewage manure in enriching the soil, and greatly increasing its productive powers, there now remains among the more enlightened class of farmers no possible doubt. Its chemical properties have been analyzed, and have been found to comprise in a highly-concentrated form all that is best adapted for making the earth yield her increase. Its application to grass lands and green crops especially has been attended with very surprising results; and from the body of evidence collected on the subject it is quite clear that, if the company are successful in the means for placing it at the disposal of the market-gardeners and farmers around London, they will give an immense impulse to the productiveness of the soil thus manured. The company are now about to commence operations, and we shall watch with interest the result of their first experiments. They will find an immense mass of ignorance and prejudice to contend with among those whose interests they seek to promote, and some time may elapse before the enlightened views which actuate them are duly appreciated, but it is impossible that the existing state of things around London can long continue, or that men will persevere in watering their crops at an expense each time of from £2 to £5 an acre, when the same can be done far more effectually with liquid manure, applied to the land by the hose at a cost of 1s. an acre. On Wednesday last some very interesting experiments were made at Stanley-bridge with several new inventions for the economic and efficient distribution of the sewage on the soil. These experiments were completely successful, and gave great satisfaction to a large and highly respectable company of gentlemen assembled on the occasion. The general result went to show the perfect ease with which the sewage can be taken from the main and applied to the land in any quantity for this purpose. Mr. Coode's patent irrigator, which was one of the implements exhibited, excited much admiration.

At the last meeting of the Ashmolean Society, Dr. Daubeny exhibited an apparatus to show an easy method of producing a light capable of superseding oil, or even gas, simply by passing a stream of atmospheric air through inflammable liquids of a volatile nature, such as ether, or the liquor condensed in the preparation of oil-gas.

MALLEABLE GLASS—AN EQUIVALENT TO.—Professor Schönbein, who invented the gun-cotton, is stated in the "Revue Scientifique et Industrielle" to have, to a certain point, discovered malleable glass! He renders paper paste (papier maché) transparent, by causing it to undergo a certain metamorphosis, which he calls catalytic, for want of a more intelligible term. He makes of this new paper window-panes, vases, bottles, &c., perfectly impermeable to water, and which may be dropped on the ground without breaking, and are perfectly transparent.—*Mechanics' Magazine.*

TO CORRESPONDENTS.

"W. C."—Marine glue is prepared in the following manner:—Digest from 2 to 4 parts of caoutchouc, cut into small pieces, in 34 parts of coal-tar naphtha, over a gentle fire, and keep stirring the mixture until the caoutchouc is completely dissolved. Add to the solution, which has the consistence of thick cream, 62 or 64 parts of powdered shellac, and heat the mixture over a gentle fire, with incessant stirring, until the mass is thoroughly fused and intermixed. Pour the mass hot upon metal plates in thin layers, and let it cool. When you want to use this cement put the requisite quantity of it in an iron vessel, and heat it to about 248° F.; apply it subsequently with a brush to the surfaces which it is desired to glue together.

"R. L. T., Brighton."—A good blue writing ink may be prepared as follows:—Take 4 ounces of sulphate of iron, 2½ drachms of sulphuric acid, about 1 ounce of nitric acid, 6 ounces of ferrocyanide of potassium, and a sufficient quantity of water. Dissolve the sulphate of iron in 1 pint of water, add the sulphuric acid to the solution, heat the mixture to boiling, and add gradually and in small portions at a time the nitric acid (keeping boiling all the while), until the whole of the iron is peroxidized. Let the liquid cool, and add it, when cold, to a solution of the ferrocyanide of potassium in a quart of water. Filter the mixture, and collect the blue precipitate which has formed on the filter. Wash this blue precipitate with distilled water until it commences to dissolve in the water. Put it now in a mortar, together with the requisite amount of pure water (more or less, according to the degree of intensity of colour you wish to produce), and aid the solution by rubbing.

"Mr. Sandhurst, Bristol."—You may procure the apparatus which you require either at Griffin's, 53, Baker-street; Button's, Holborn-bars; or Knight's, Foster-lane, Cheapside.

"R. W."—Dissolve 16 grains of the salt in 1 ounce of water.

"Natura."—Dr. Lindley's "School Botany and Introduction."

"Beta."—We are unable to give you any information on the subject.

"M. J."—Common river water will answer the purpose. You must use concentrated (fuming) sulphuric acid.

"F. S., Liverpool."—Will our correspondent favour us with his name and address?

"R. T. V."—The ecitor has not yet returned from the Continent.

"Mr. Sinclair, Manchester."—Apply at Apothecaries'-hall. Any other course of proceeding would be imprudent.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—March 24, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Memoirs, &c.

Lecture X.

We discussed in the last lecture salicine, saligenine, helicine, helicoidine, and rutiline, finishing with the process for procuring hydride of salicyle — salicylous acid. In the air this acid is not altered. When heated with potassa it passes into salicylic acid; the same change occurs when it is boiled with chromic acid. Salicylous acid expels carbonic acid from the alkalis, forming salts difficultly soluble in water. Sesquichloride of iron partakes of a violet hue mixed with the acid, or its salts. Salicylous acid may be represented as a hydrogen compound of the radical salicyle:—

$$C_{14}\ H_5\ O_4 + H.$$

And when the hydrogen is replaced by another metal we have the salicylide of that metal. We will represent the formulæ of a few of the leading salts:—

Salicylide of hydrogen.. H, $C_{14}\ H_5\ O_4$
Salicylide of potassium.. K, $C_{14}\ H_5\ O_4 + 2Aq$
Salicylide of barium.... Ba, $C_{14}\ H_5\ O_4 + 2Aq$
Salicylide of copper .... Cu, $C_{14}\ H_5\ O_4$.

Salicylide of hydrogen, heated slightly with weak nitric acid, yields nitrosalicylous acid, which may be obtained in yellow prisms from alcohol. It is abundantly dissolved by alcohol and ether, only slightly by water. This acid has a powerful action upon the skin, tinging it indelibly yellow. An alcoholic solution of nitrosalicylous acid, treated for a long time with sulphide of hydrogen, assumes a dark colour. Water precipitates brownish flakes from the menstruum. Hydrochloric acid throws down a reddish sulphur compound. Nitrosalicylous acid, like nitrosalicylic acid,* is converted, by fuming nitric acid, into carbazotic acid. Nitrosalicylides have not been analyzed. Their composition will no doubt correspond to the salicylides. The acid may be represented by the following:—

$$H, C_{14}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\} O_4$$

i. e., the hydride of a compound radical, in which peroxide of nitrogen take the place of the fifth atom of hydrogen in salicylous acid.

You are aware that salicylic acid is the result of the action of potassa upon salycilous acid. When the two are mixed and heated they become brown, hydrogen escapes, the colour then disappears. Weak hydrochloric acid must now be added, and the whole boiled. Salicylic acid separates from the hot solution in crystalline laminæ. Salicine added in successive portions to hydrate of potassa, in a silver basin, loses hydrogen. By heating with hydrochloric acid, as above, salicylic acid is obtained, which may be purified by recrystallization. This acid in a sublimed state is analogous to benzoic acid. It is almost insoluble in water, but is copiously dissolved by alcohol and ether. The taste of the acid is sweetish and irritating. Exposed to a high temperature, it is decomposed, spirole being formed, identical in composition with carbolic acid. The same product is obtained in a larger quantity by heating salicylic acid and lime together:—

$$\underbrace{C_{14}\ H_5\ O_5}_{\text{Salicylic acid.}} + Aq + 2CaO = C_{12}\ H_5\ O + Aq + 2(CaO\ CO_2).$$

By the absorption of oxygen, salicylic acid acquires a bluish colour. It is energetically acted upon by fuming nitric acid, giving rise to nitrosalicylic and nitropicric acids. Chlorine and bromine afford with the acid chlorinated and brominated compounds:—

Monochlorosalicylide of hydrogen ..... $H, C_{14}\left\{\begin{matrix}H_4\\Cl\end{matrix}\right\} O_6$
Bichlorosalicylide of hydrogen ..... $H, C_{14}\left\{\begin{matrix}H_3\\Cl_2\end{matrix}\right\} O_6$
Monobromosalicylide of hydrogen ..... $H, C_{14}\left\{\begin{matrix}H_4\\Br\end{matrix}\right\} O_6$
Bibromosalicylide of hydrogen ..... $H, C_{14}\left\{\begin{matrix}H_3\\Br_2\end{matrix}\right\} O_6$
Tribromosalicylide of hydrogen ..... $H, C_{14}\left\{\begin{matrix}H_2\\Br_3\end{matrix}\right\} O_6$

Cahours has examined the salts of salicylide of hydrogen; their general formula is:—

$$M, C_{14}\ H_5\ O_6.$$

We possess in the indigo, salicyle, and phenyle families well examined groups of organic bodies, in many respects connected with each other. There appears to be parallel with these another extended series of analogous compounds, differing only in $C_2\ H_2$. As I intend presenting to you a tabular view of the four it will be as well to proceed at once to the description of the anisyle substances. Anisyle is a name given by Cahours to the hypothetical radical of a series of compounds from oil of anise. This oil has a pale yellow colour and a strong odour of the seed of Pimpinella anisum. It contains two isomeric compounds, a liquid and a solid; the latter is the most abundant, and from it the principal substances are derived. Its formula is:—

$$C_{20}\ H_{12}\ O_2.$$

With dilute nitric acid it affords hydride of anisyle and anisic acid.

The hydride of anisyle is an amber-yellow oil possessing a burning taste and an aromatic odour. Anisic acid is produced by acting upon hydride of anisyle with fused potassa; hydrogen gas escapes, and oxygen is assumed:—

$$\underbrace{H, C_{16}\ H_8\ O_4}_{\text{Hydride of anisyle.}} + O_2 = \underbrace{C_{16}\ H_8\ O_6}_{\text{Anisic acid.}} + H$$

Bromine converts anisic acid into bromanisic acid. Chlorine forms with it a similar compound. Oil of anise, boiled with concentrated nitric acid till the whole of the products formed are dissolved, gives on dilution a yellow flocculent matter—impure nitranisic acid. To purify it the crystals must be dissolved in ammonia, the salt produced crystallized till colourless, then decomposed by an acid. Nitranisic acid falls, and must be well washed. From a hot aqueous solution it is obtained in fine acicular crystals. Anisole results from the distillation of anisic acid and lime:—

$$\underbrace{C_{16}\ H_8\ O_6}_{\text{Anisic acid.}} + 2CaO = \underbrace{C_{14}\ H_8\ O_2}_{\text{Anisole.}} + 2(CaO\ CO_2)$$

Portions of the hydrogen in anisole have been replaced by bromine and peroxide of nitrogen.

Oil of estragon, from Artemisia dracunculus, is identical with anise oil; and the draconic acid, obtained from it by Laurent, is the anisic acid.

You will perceive in the annexed table the indigo, salicyle, and phenyle, collaterally with the anisyle, &c., series. There are many of the analogues needed in the latter series; in fact, the group of indigo is entirely wanting; but the vast strides that science is daily taking make the gaps in each type of compounds much smaller:—

Indigo, Salicyle, and Phenyle Series.		*Anisyle Series, &c.*	
Indigo	$C_{16}H_5NO_2$		
Isatine	$C_{16}H_5NO_4$		
Chlorisatine	$C_{16}\left\{\begin{matrix}H_4\\Cl\end{matrix}\right\} NO_4$		
Dichlorisatine	$C_{16}\left\{\begin{matrix}H_3\\Cl_2\end{matrix}\right\} NO_4$		
Salicylic acid	$C_{14}H_6O_6$	Anisic acid	$C_{16}H_8O_6$
Bromosalicyle	$C_{14}\left\{\begin{matrix}H_5\\Br\end{matrix}\right\} O_6$	Bromanisic acid	$C_{16}\left\{\begin{matrix}H_7\\Br\end{matrix}\right\} O_6$
Dibromosalicyle	$C_{14}\left\{\begin{matrix}H_4\\Br_2\end{matrix}\right\} O_6$		
Tribromosalicyle	$C_{14}\left\{\begin{matrix}H_3\\Br_3\end{matrix}\right\} O_6$		
Nitrosalicylic acid Indigotic acid	$C_{14}\left\{\begin{matrix}H_5\\NO_4\end{matrix}\right\} O_6$	Nitranisic acid	$C_{16}\left\{\begin{matrix}H^7\\NO_4\end{matrix}\right\} O_6$
Phenole Hydrate of phenyle	$C_{12}H_6O_2$	Anisole	$C_{14}H_8O_2$
Bromophenole Bromophenasic acid	$C_{12}\left\{\begin{matrix}H_5\\Br\end{matrix}\right\} O_2$	Bromanisole	$C_{14}\left\{\begin{matrix}H_7\\Br\end{matrix}\right\} O_2$?
Dichlorophenole Chlorophenissic acid	$C_{12}\left\{\begin{matrix}H_4\\Cl_2\end{matrix}\right\} O_2$	Dibromanisole	$C_{14}\left\{\begin{matrix}H_6\\Br_2\end{matrix}\right\} O_2$
Trichloraphenole Chlorophenissic acid	$C_{12}\left\{\begin{matrix}H_3\\Cl_3\end{matrix}\right\} O_2$		
Pentachlorophenole Chlorophenusic acid	$C_{12}\left\{\begin{matrix}H\\Cl_5\end{matrix}\right\} O_2$		
Dinitrophenole Nitrophenesic acid	$C_{12}\left\{\begin{matrix}H^4\\2NO_4\end{matrix}\right\} O_2$	Dinitranisole	$C_{14}\left\{\begin{matrix}H_6\\2NO_4\end{matrix}\right\} O_2$
Trinitrophenole Carbazotic acid Nitrophenisic acid	$C_{12}\left\{\begin{matrix}H_3\\\\3NO_4\end{matrix}\right\} O_2$		
Anthranilic acid	$C_{14}H_7NO_4$		
Salicylous acid	$C_{14}H_6O_4$		
Benzoic acid	$C_{14}H_6O_4$		
Nitrobenzoic acid	$C_{14}\left\{\begin{matrix}H_5\\NO_4\end{matrix}\right\} O_4$		
Benzole	$C_{12}H_6$	Toluole	$C_{14}H_8$
Sulphobenzide	$C_{12}\left\{\begin{matrix}H_5\\SO_2\end{matrix}\right\}$	Sulphotoluide	$C_{14}\left\{\begin{matrix}H_7\\SO_2\end{matrix}\right\}$?
Hyposulphobenzidic acid	$C_{12}H_5S_2O_5$	Hyposulphotoluidic acid	$C_{14}H_7S_2O_5$
Chlorbenzole	$C_{12}\left\{\begin{matrix}H_3\\Cl_3\end{matrix}\right\} + 3ClH$	Products of the action of chlorine upon toluole	$C_{14}\left\{\begin{matrix}H_7\\Cl\end{matrix}\right\}$ $C_{14}\left\{\begin{matrix}H_5\\Cl_3\end{matrix}\right\} + ClH$ $C_{14}\left\{\begin{matrix}H_3\\Cl_3\end{matrix}\right\} + 2ClH$ $C_{14}\left\{\begin{matrix}H_3\\Cl_5\end{matrix}\right\} + 3ClH$ $C_{14}\left\{\begin{matrix}H_2\\Cl_6\end{matrix}\right\}$
Chlorbenzide	$C_{12}\left\{\begin{matrix}H_3\\Cl_3\end{matrix}\right\}$		
Nitrobenzide	$C_{12}\left\{\begin{matrix}H_5\\NO_4\end{matrix}\right\}$	Nitrotoluide	$C_{14}\left\{\begin{matrix}H_7\\NO_4\end{matrix}\right\}$

* Vide Lecture VII., page 192.

Binitrobenzide	$C_{12}\left\{\begin{matrix}H_4\\2NO_4\end{matrix}\right\}$
Azobenzide.....	$C_{12}H_5N$
Aniline	$C_{12}H_7N$
Bromaniline	$C_{12}\left\{\begin{matrix}H_6\\Br\end{matrix}\right\}N$
Dibromaniline	$C_{12}\left\{\begin{matrix}H_5\\Br_2\end{matrix}\right\}N$
Tribromaniline	$C_{12}\left\{\begin{matrix}H_4\\Br_3\end{matrix}\right\}N$
Chlorodibromaniline	$C_{12}\left\{\begin{matrix}H_4\\Cl_2\\Br\end{matrix}\right\}N$
Nitraniline.....	$C_{12}\left\{\begin{matrix}H_6\\NO_4\end{matrix}\right\}N$
Binitrotoluide	$C_{14}\left\{\begin{matrix}H_6\\2NO_4\end{matrix}\right\}$
Toluidine.....	$C_{14}H_9N$

I must again refer to the equation system of representing acids as hydrogen compounds. You know from experience it *simplifies* the science, and, wherever it can be introduced with advantage to the student, the teacher and lecturer should follow it. The veil of mysticism is daily dispersing, the mere abecedarian now possessing a clue to the components of substances in their names owing to the improvement in scientific nomenclature; and the zeal with which chemistry has been extended, and with which it is still pursued by distinguished chemists throughout Europe, leaves to the inquiring mind an accessible field, if it be endowed with ordinary talent and perseverance.

THE NEBULAR THEORY.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION, MARCH 23, 1849.

By Professor BADEN POWELL.

The system of opinions known as the nebular theory or hypothesis is one which has excited a degree of attention which, when we consider how very abstract its objects are, and how little they appeal to the interests and feelings of men, appears to me very extraordinary. The controversy to which it has given rise has even extended beyond the scientific world, strictly so called, and has brought into the field combatants from every quarter. Whatever may be the cause of this circumstance, or whatever the merits of the question, the fact remains the same. It is undeniable that the subject has awakened an unusual degree of interest. Very recently an accession of interest has arisen from the testimony and observations of Lord Rosse on the discoveries made with his telescope, and it has been very confidently asserted, especially in the daily prints, that discoveries have been made by that nobleman which would knock this theory on the head. Since the subject has excited this kind of interest and discussion, I propose on the present occasion to take a line different from that which many might wish, and to inquire first what the real nature of this theory is, and afterwards glance at the evidence by which it is established. And here, as in many other cases, I think it will be found that truth lies between two extremes of opinion. Neither the extreme defenders of this theory, nor those who altogether reject it, will be found to be precisely correct. There are, as it seems to me, two very distinct subjects often confounded in speaking of the nebular theory. I will illustrate them separately. The first of these subjects, and apparently the simplest to comprehend, is what is called the nebular theory of Herschel, with whom the use of the expression originated. The term was at once adopted as furnishing a very convenient phrase for expressing an hypothesis on certain appearances in the sky observed with powerful telescopes. Every one who is accustomed to regard the sky knows that in a certain part of the heavens a more luminous appearance is presented than in any other, and that it has been called the milky way. It has the appearance of surrounding the sky with a nebulous ring. A telescope of very moderate power resolves this nebulous appearance into a number of small stars. Instead of that undefined aggregation of luminous particles, order and distinctness are recognisable, and the particles are separated into an immense number of small stars. The same thing is true of certain apparently similar bodies in the sky, some of which are visible to the naked eye, and are resolvable by the telescope into minute stars. Other nebulous appearances are only discernible by the aid of telescopes, and resemble a bright cloud; these when regarded through yet larger instruments are again resolvable into innumerable small stars aggregated together in a cluster. Many nebulæ give way before a telescope of comparatively small power; others require a larger instrument, and the greater the capacity of the instrument the more and more stars will be resolved. It should, then, certainly be no wonder that Lord Rosse by his very powerful telescope has been able to resolve into stars a great deal of luminous matter which has hitherto not been so determined; but to assert, as has been done, that he has resolved all the nebulæ, and by his discoveries put an end to all doubt or conjecture on the existence of nebulæ, is most unphilosophical and contrary to all truth. Lord Rosse himself says that he has examined with his telescope not more than two thirds of our hemisphere. That alone stamps the statement with falsity. Then, again, in those which he has examined there are very curious particulars disclosed which, as I shall show, go far to confirm the nebular theory. And let it be understood that when I say Lord Rosse has done thus or thus I speak of what he has himself published as having himself done. I do not recognise the daily newspapers as speaking for him: the communications made from time to time may or may not have his authority. What Lord Rosse has thought fit to publish is to all intents and purposes scientific evidence, but nothing else can be. Now, what he says is only the result of observations on a very small number of nebulæ: he says he has examined many of which he has published nothing, but of those nebulæ concerning which he has told us anything the number is very few; but they are important in the resolution they exhibit. Now, Sir William Herschel's researches showed that these nebulous appearances in the sky might be divided and classified like the objects of natural history: accordingly he arranged them under four heads or into four classes, further distinguishing them as genera and species. There are two or three of these distinctions we may very profitably notice. Of the nebulæ some are immediately resolvable into clusters of stars; others are aggregations of luminous matter, which, when observed with telescopes of the highest power, are always accompanied with nebulous matter unresolvable into stars; further, there are some single stars surrounded by a nebulous atmosphere; and lastly, there are films of nebulous matter, like a cloud having no definite form or shape, but alike under all powers of the telescope. These four classes seem to present natural grades for purposes of reference. Now, Lord Rosse expressly cautions us against supposing that, because in certain instances he had resolved nebulæ before considered unresolvable, he therefore means to intimate that all nebulæ would ultimately be resolved. Again, Sir John Herschel, who has paid great attention to the subject, speaks in a tone equally cautious, and says that he firmly believes that no positive opinion can be produced on the subject of all nebulæ being ultimately resolvable or not, and he points out several important distinctions which seem to show there are nebulæ not resolvable at all. Among others he points out this important fact, that those nebulæ which have a tendency to assume a round, ellipsoidal, or even flattened ellipsoidal form are easily resolvable into component stars, aggregations kept together by systems of their own; the nature of which we can, of course, only conjecture, and can scarcely find materials for doing even that, but that the filmy nebulæ which I last spoke of, which take no particular form, but which are, some filamentous, some straight, some curved, are of a distinct nature, and never to be resolved. I will not go into any considerations on the probable forces which may keep such systems of aggregated stars together in equilibrium, as that would lead us too far from the subject more immediately in hand. What is more important is the remark verified by the observations by Lord Rosse of these nebulæ, that, in proportion as the telescopes employed rise in power and resolve a greater number of nebulæ into stars, they at the same time reveal more of the filmy nebulæ which are not resolvable. This I take to be a more important fact, and is an answer to the assertion that nebulous matter is likely to vanish from the heavens through the improvements in telescopes. We may reasonably conceive that with higher powers of observation we shall go on in a similar manner resolving, indeed, many nebulæ into stars, but revealing in a greater proportion a quantity of luminous matter never to be resolved. On the whole, I would say, as the general result of recent researches into nebulæ with higher and higher powers applied to their observation, shows that, whatever be the powers employed, nebulous matter exists everywhere, but in different degrees and stages of condensation, no improvements in telescopes can affect this law. There is the same relative difference between resolvability and unresolvability with the higher as with the lower power, though the absolute difference is altered. In the one case nebulous matter is more resolvable than the other, but the proportion of resolvable and unresolvable remains unchanged. In nebulæ of the second class it is to be remarked that, wherever they are resolvable into separate stars, those stars exist in immense numbers; as if the nebulous matter had a tendency to condense not to one but to many centres of condensation. There may be, and probably are, a great number, we might almost say an infinite number, of these centres.

When we look to the general structure of the sidereal heavens, so far as we can investigate them in this way, we are led to the conclusion that the milky way is itself one aggregation of a multitude of stars, constituting a cluster exactly similar in nature to those which we discern by the telescope; that in the midst of this cluster our own solar system exists as forming one star, with its attendant luminous points; that the form of our system is a cone, and that on the side of its horizontal axis are similar clusters.

This is the first of those two subjects which I told you had been confounded in discussing the nebular theory. This theory of the sidereal clusters was laid hold of by Laplace as presenting an analogy, not between our system and one of those clusters, but in the condensation of matter to centres, and the probable existence of matter in different stages of condensation. The idea Laplace suggested was that of progressive formation by condensation to centres. This idea was formed on the speculations of Herschel. We come, then, to the nebular theory of Laplace, the more proper topic of our discourse. Against that system a variety of objections have been raised. We will first consider its nature, and then examine these objections. Laplace stated, on an examination of all the

bodies of which the solar system is composed, that, with some unimportant exceptions, the movements of the planets and their satellites are all nearly in the same plane, and in the same direction; and he considered it a good inference from this fact that their motions must all have had a common cause. He supposed that the matter of which our system is composed might have existed in a highly expanded or nebulous state, and that the power then keeping it in that state was an intense degree of heat, since we know from geology that heat was largely concerned in making our globe what it is, and that at the earth's centre an accumulation of heat exists, from which it is probable that the matter of the whole was once in a state of fusion.

This view of the original nebulosity of the earth has been adopted by Humboldt: matter in this nebulous condition he calls fire-mist, star-dust, &c. The theory goes on to suppose that this matter was consolidated and contracted on cooling, that separate rings were thrown off, and that these rings consolidated into planets which gathered round the central mass or sun. Laplace demonstrated on dynamical principles that such a theory might account for the actual motions of the planetary bodies. Then, with respect to their rotatory motion, we all know that if two equal forces from opposite points impinge upon a body on its opposite sides, but, however, not exactly in the same line, but so that one shall strike the body a little below and that on the other side a little above its centre of gravity, a rotatory motion will be the result. Now, this is what Laplace supposes to have been the case, and its possibility he demonstrated mechanically. To this theory there have been some very ingenious objections made, on the ground that the agency of heat was not alone active. Heat alone, it is true, would not be sufficient to produce these effects; but it seems to be forgotten that there were and must have been other and powerful agencies at work. Then, again, an objection has been taken to this theory beeause the orbits of all the planets are inclined, and many of them very much inclined, to the plane of the ecliptic. To both of these arguments we may reply that of course the expansion of matter could not be produced by one agent, but there were a multiplicity of forces, and the tendency of the matter was to eondense at one part further than another.

Now, one principal consideration is that this tendency to condense to different centres is not altogether an arbitrary supposition, because it is analogous to what we have seen in the sidereal nebulæ; in these we actually see condensation taking place to separate centres in the same mass; and why not, therefore, in similar masses? But we have similar instances nearer home: in every comet we have a mass of nebulous matter, since it is thin and transparent; and we have an instance of condensation to a centre; and in that remarkable instance in 1846, the separation of a eomet, we have a case of condensation to two centres.

In this ease there was a process going on under the very eyes of the observer of the very kind I am arguing for the possibility of. One day it was seen as one comet, the next day it was seen to have divided, at first without any apparent nucleus, and shortly afterwards, in a further stage of condensation, with a nueleus, and brighter. If we wished to multiply examples of the existence of nebulous matter, we might take the zodiacal light recently reported on by Sir John Herschel, who enjoyed a splendid opportunity of examining it at the Cape of Good Hope. This light has the appearance of a luminous mist. Stars are seen through it, and appear to stand in the foreground. It was the opinion of several eminent astronomers that the zodiacal light was a ring of matter. I will here quote the opinion of the late Mr. Bailey, who thus speaks of comets:—Our system he eonceives was once nebulous, and that comets are different portions of it which have not experienced the condensation which the planets have. They are hence of an unsubstantial nature. He supposes that they at first described parabolas round the sun, and then, from the resistance of uncondensed nebulous matter remaining in the system after the planets were thrown off, they were constrained to return to orbits like their present. He calls them a link between the present and the former state of our system, and, from their obedience to the law of gravitation, he concludes matter to have been subject to that law from the beginning, and that the law will be good for it after the present systems are destroyed. In the constellation of Orion is observed a slight nebulous appearance, which you might suppose was a starry nebula with a star in the centre; it is nothing of the kind; it is a eomet, the comet of Encke, that comet of a very small period, returning every three and a half years. In this comet you may perceive a bright portion which you might suppose to be a nucleus, but it is in reality a small star in the constellation of Orion, which is visible through the comet. Encke's comet must, therefore, be of a substance thinner than the thinnest, since otherwise it would be impossible to perceive the star. Such is a specimen of some of the nebulous mists belonging to our system. There is reason to believe that the quantity of uncondensed nebulous matter existing in our system is very large indeed. Ceres and Pallas are two planets around which a considerable collection of such expanded matter has accumulated. I need not here repeat the argument which I developed on a former occasion, and which demonstrates the existence of collections of uncondensed matter in our system, from the showers of meteors and meteorolites observable more or less at all times, but especially about the 13th of November in every year; these are to be considered as parts of larger accumulations existing about our system, which are occasionally brought to the earth. Portions of the matter of our system exist in the nebulous state, and these are probably the remaining uncondensed portions of the matter out of which the earth was originally formed. But there is one class of objections to the theory of which notice must be taken. It is said that if we conceive a mass of matter in the nebulous state condensing to a centre and rotating, and planets being thrown off from it, the planets it throws off would revolve with the velocity they before had, and the central mass with the same velocity. According to this argument the orbits of the remotest planets thrown off the sun should thus be described within the same period of time that the sun turns completely round on its axis, and the moon, regarded as originally thrown off the earth, should perform its circuit in one day instead of twenty-seven. But those who thus argue omit to consider that, if the planet at the outer ring has left the centre, the central mass will acquire a much more rapid motion. Of this any one may satisfy himself by tying a piece of string to a plummet, whirling it round, and contracting the circle by shortening the string, which is its radius; the plummet will be found to revolve more rapidly as it is drawn off by the string nearer to the centre; rapidity is thus proportioned to the length of the radii. Further, it is to be remembered that as condensation goes on, and the planet thrown off begins to revolve, the uncondensed matter left behind forms a resisting medium. *In vacuo* a body will rotate freely, but on interposing a resisting medium motion will be slower and slower. Lastly, bear in mind the great number of forces originally present in the mass to set the planets going. These we may conceive were sufficient to have driven the planets into any degree of inclination, and to send them across the ecliptic. Far from supposing that the consideration of heat alone accounts for the original existence of matter in the nebulous state, its condensation, and the throwing off of the planets from a central mass, the supporters of this theory urge in its behalf that a great number of forces, all that we call light, magnetism, electricity, &c., were present in an active state. It is too often forgotten that the nebular hypothesis is not proposed as a demonstrated or real philosophical statement of facts. Numberless mistakes have been made, and much needless warmth imparted to controversy, through overlooking its proper object. This is merely to explain facts, to assign a sufficient cause for them; if the nebular theory accomplishes this its end is gained. It may be described as a philosophical fiction; we do not require that its incidents should be literally true, as in a novel we do not demand real circumstances, dates, and places; but we must have nothing that might not have been true, no acts from insufficient motives, no motives without analogous consequences. The nebular theory, then, bears just the same relation to science as fiction does to history, and requires, not historical facts, but analogy and probability. It is a subject which ought to be investigated in that light only; it is perfectly lamentable to see the heat and vehemence with which some persons of note have taken the matter up. It is simply a beautiful speculation, and, if any one can show it to be contrary to any known scientific fact, that it is opposed to any dynamical law, or frustrates any mechanical doctrine, by all means let this be done. It has further been objected to as unduly exalting physical influences and as standing opposed to theological truth; but of all objections to make to an unsubstantial theory I think this is the most futile and absurd. But, supposing for a moment that the system were a well-established philosophical theory, made out with all the rigour of demonstration, what would be the inference from it? What is the study of physical causes, taking a rational view of them, but an investigation of the principles on which the operations of the Supreme hand are carried out? This inquiry only aims at tracing out the steps and secondary causes by which the Divine will accomplished its glorious purposes. In proportion as we can advance to further steps in the chain of causes, and as we go higher and higher, and trace further and further indications in the train of physical causes, do we gain additional evidence in favour of the great moral cause whose manifestations we discern in the order and harmony of the whole creation.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

PREPARATION OF IODIDE OF LEAD.

By M. T. HURAUT.

Small quantities of iodide of lead may be prepared indiscriminately by any of the several known processes, since the products of all of them are equally pure, and differ but slightly in a quantitative point of view from each other, and from the amount indicated by theory. But in the preparation of large masses of iodide of lead these quantitative differences beeome of considerable importance, and the selection of one or other of the various processes is by no means a matter of indifference.

M. Huraut has made a series of experiments with a view to ascertain which of the several processes usually resorted to yields the largest amount of product. He employed in every one of these experiments a quantity of iodide which, by theoretical calculation, ought to have yielded 18.20 grammes of iodide of lead. He obtained the following results:—

PREPARATION OF IODIDE OF LEAD BY DOUBLE DECOMPOSITION OF IODIDE OF POTASSIUM AND A SALT OF LEAD.

The French Codex prescribes the neutral acetate of lead; but MM. Depaire and F. Boudet having discovered that the acetate of potass, to the formation of which the process of double decomposition gives rise, in this instance, dissolves nearly one tenth of the newly-formed iodide of lead, the use of the neutral acetate of lead has been generally abandoned, and nitrate of lead has been substituted for it.

M. Huraut obtained with the neutral acetate of lead from 13.10 grammes of iodide of potassium (containing 10 grammes of iodine) 15.70 to 15.80 grammes of iodide of lead.

With the nitrate of lead he obtained from the same quantity of iodide of potassium 17.50 to 17.55 grammes of iodide of lead.

The iodide of lead prepared by this process is of a fine lemon colour, and perfectly soluble in boiling water.

IODIDE OF SODIUM AND A SALT OF LEAD.

A quantity of iodide of sodium corresponding to 10 grammes of iodine yielded with acetate of lead 15.90 to 16.10 grammes, with nitrate of lead 16.85 to 16.95 grammes, of iodide of lead.

The product was of the same quality as that prepared with iodide of potassium.

IODIDE OF CALCIUM AND A SALT OF LEAD.

A quantity of iodide of calcium containing 10 grammes of iodine yielded with acetate of lead 17.25 to 17.40 grammes, with nitrate of lead 17.60 to 17.70 grammes, of iodide of lead.

The iodide of lead prepared from iodide of calcium has a fine orange-yellow colour, and is of superior quality.

IODIDE OF IRON AND A SALT OF LEAD.

Ten grammes of iodine converted into iodide of iron yielded with neutral acetate of lead 16.70 to 16.75 grammes, with nitrate of lead 17.50 grammes, of iodide of lead, of an orange-yellow colour, and perfectly soluble in boiling water.

IODIDE OF ZINC AND A SALT OF LEAD.

Ten grammes of iodine converted into iodide of zinc yielded with neutral acetate of lead 17.05 to 17.15 grammes, with the nitrate 17.40 to 17.45 grammes, of iodide of lead, of a pale orange-yellow colour.

From the results of these experiments it appears that the process of preparing iodide of lead from iodide of calcium is the most advantageous of all, both as regards the quality and quantity of the product.

The process of preparing the iodide of lead from iodide of sodium yields much less satisfactory results, and that with iodide of potassium is the least economical of all.

The iodide of iron and iodide of zinc processes yield equally fine and copious products; it is almost a matter of indifference which to employ of the two. Yet the ready solubility of iodide of zinc, its inalterability in the air, and the facility with which it is prepared, may be considered to turn the scale in favour of the latter salt.—*Journal de Pharmacie et de Chimie*, Jan., 1849.

ON THE RATIONALE OF THE EXPLOSION CAUSING THE GREAT FIRE OF 1845 AT NEW YORK.

By Dr. HARE.

At a recent meeting of the members of the Franklin Institute Dr. Hare presented some inferences and facts tending to explain the contradictory impressions which have existed respecting the competency of fused nitre to explode with water, or with aqueous, hydrogenous, and carbonaceous combustibles. This subject was treated of in reference to a series of detonations terminating in an explosion of tremendous force, by which, in July, 1845, the intensely-ignited contents of a store in Broad-street, New York, were thrown over an extensive district, involving the destruction of about 200 houses and property estimated at two millions of dollars. As far as the oaths of highly competent witnesses could avail, no gunpowder was present, so that the result could only be attributed to the reaction between an enormous quantity of nitre and combustible merchandise with which the store was promiscuously occupied. In all there were 300,000 lbs. of nitre in parcels of 180 lbs. (each secured by two bags, an additional bag having been put over that originally employed). About 30,000 lbs. were situated upon the first floor, 180,000 on the second floor, and 80,000 on the third floor.

Of the merchandise, the aggregate was more than double the weight of the nitre.

It was, however, the general opinion of those best acquainted with the subject that, when ignited with combustibles, nitre produces only that species of combustion which is called deflagration by chemists, without being capable of the more violent and instantaneous reaction designated by the word explosion. This impression was strengthened by the failure of every effort (made by several eminent chemists employed by the corporation of New York) to explode nitre by ignition with combustibles.

Nevertheless, agreeably to Hays, of Massachusetts, an explosion was effected in his laboratory, by bringing water into contact with about 100 lbs. of incandescent nitre; also the accidental falling of a jet of melted nitre on some water in the laboratory of the University of Pennsylvania had been productive of a similar result.

The explosion of a vessel laden with nitre, which, while lying in Boston harbour, was burnt to the water's edge, and of others similarly laden and burnt, could only be explained by supposing that nitre, when sufficiently heated, will explode with water on due contact. Consistently, it might be inferred that this salt (well known to be a compound of nitric acid and oxide of potassium or potash) would explode with any substance capable of yielding either or both of the elements of water or hydrogen. The presence of the latter would be equivalent to water, since it would, with the oxygen of the acid, form water.

In a letter addressed to the distinguished chemist above mentioned, in July, 1845, Dr. Hare had adverted to the explosion which succeeds the combustion of potassium upon water, as arising from the combination of one portion of the water with the resulting incandescent globule of oxide, while the heat of this globule, uniting with another portion of the liquid, converts it into high steam. Moreover, it was suggested that in this instance chemical affinity between the water and the oxide, in causing the water and heated globule to coalesce, is equivalent in efficacy to the momentum of the hammer when a bar of iron, at a welding heat, is forced into contact with some moisture situated upon an anvil.

Dr. Hare presumes that no explosion can take place unless the reagents for producing it are held or brought together at the moment of reaction, by a certain force, either chemical or mechanical.

Some chemical compounds, such as are formed with fulminic acid or with ammonia by metallic oxides, also the chloride of nitrogen and perchloric ether, explode violently without confinement, so as to fracture a plate or saucer, upon which a small quantity may be detonated; but pulverulent mixtures, such as gunpowder, however powerfully explosive when employed in gunnery or rock-blasting, in open vessels flash without fracturing them, or producing any report. In an exhausted receiver gunpowder is far less explosive than when subjected to atmospheric pressure in an open vessel. Nevertheless, when gunpowder is restrained until the temperature requisite for the appropriate reaction of its ingredients is attained, it exerts a force far exceeding that which the chamber confining it is capable of resisting. In this respect it differs from steam, of which, when the temperature of the fire applied is sufficiently high, the explosive force is directly as the pressure immediately before bursting, and this, of course, is commensurate with the strength of the confining boiler.

The ingredients of gunpowder, sulphur, charcoal, and nitre, to produce the greatest effect, require extreme comminution and intimate intermixture by trituration, and to be so granulated that the flame of the portion first ignited may convey inflammation to the rest through the interstices between the grains. Its superiority over any other mixture of nitre with combustible matter, destitute of sulphur, is conceived to be due not only to the pre-eminent susceptibility of this substance of vaporization and inflammation, but likewise to its well-known ability to decompose metallic oxides by attracting both the metal and oxygen. Since an opinion was expressed in 1845, in the letter above mentioned to Hays, that the formation of sulphide of potassium is the first step in the process of the explosive reaction of gunpowder, Faraday has alleged the flame of this compound to be, in the case in point, an important instrument in the propagation of fire throughout the mass.

The hepatic odour of the fumes consequent to the firing of cannon, and likewise of the washings of a gun after the customary service, demonstrate the production of a sulphide. It has been found that a filtered solution of the residue displays, when tested by iron, the red hue which indicates the presence of a sulphocyanide.

Agreeably, however, to a qualitative examination, the solid residue of exploded gunpowder consists mainly of nearly equal parts of carbonate and sulphate of potash, while the gaseous residue is constituted nearly of equal volumes of carbonic acid and nitrogen. Of course the sulphate may arise from the oxidation of sulphide formed at the outset. Notwithstanding that the ingredients of gunpowder are prepared as above stated, confinement is necessary to prevent the grains from being thrown apart and chilled, so as to prevent the propagation of the ignition, through the congeries forming a charge, by means of the flame of the first portions fired. This was fully demonstrated by the exposure of a pile of gunpowder, comprising enough for the charge of a musket, within an exhausted receiver, to a wire intensely ignited by a galvanic discharge. The grains did not take fire instantly, probably because the vapour evolved prevented actual contact; and when ignition did ensue it extended only to the production of a feeble flash. On examination it was found that a portion of the powder had escaped inflammation.

In the next place, a like weight of gunpowder was consolidated into a cylinder by intense pressure. Thus prepared and ignited, by contact with an incandescent wire, in the exhausted receiver, more than half of the cylinder remained unconsumed.

A much larger cylinder of the same mixture, similarly consolidated, placed at the bottom of an iron pot, four inches in diameter and twelve inches in depth, on being touched by the end of an iron rod reddened in the fire, burnt at first like a squib, but towards the last was dissipated with an activity in some degree explosive, probably in consequence of the pressure created by the reaction of the gaseous current generated by its own deflagration.

The want of confinement, which is thus capable of lessening the explosiveness of gunpowder, of which the constituents are intimately intermingled, is still more enfeebling, where analogous reagents are ignited together without admixture or comminution. Under these circumstances, the reagents are made to recede from each other by the generation of that vapour or gas to the evolution of which, under confinement, the capability of exploding is due. Thus sundered, they are chilled by radiation, so that the temperature requisite to sustain and communicate ignition is not supported. Moreover, the rapidity of reaction being as the multiplication of the points of contact, and these being fewer as the substances are less divided and intermingled, the deflagration takes place in detail, instead of having that simultaneousness which is indispensable to render it explosive.

In addition to the ideas above mentioned as having been conveyed in Dr. Hare's letter to Hays, it was urged also that his inference as to the explosion of water with incandescent nitre being attributable to a reaction analogous to that represented as taking place when potassium is burnt with the oxide of hydrogen was supported by the fact, that at a white heat the base of nitre spontaneously abandons its acid, while from water it cannot be separated by any tem-

perature. Consequently, the presentation of substances consisting of carbon, hydrogen, and oxygen, by yielding water to the base, could not but be productive of a result analogous to that which results from the presentation of sulphur and carbon.

The only obstacle is as follows:—Substances containing hydrogen and oxygen, whether in the proportion for forming water, like sugar, starch, gum, and wood, or having an excess of hydrogen, like oil and resins; moreover, all the constituents of nitre, even the base; are susceptible of the aëriform state at the temperature producible by the reaction of nitre with them. But, when kept together until that point is attained, the explosive power must be fully equivalent to that of gunpowder. The reagents are in a state analogous to that of two gases extremely condensed.

The explosibility of incandescent nitre with water was illustrated in the small way by heating a portion in a platina capsule by the flame of a hydro-oxygen blowpipe, and sudden immersion in the liquid. So active was the explosion that a portion of the resulting hydrate flew out upon the operator. Yet, when thrown in the same state upon molasses or sugar, no explosion ensued: nevertheless, when a capsule containing nitre heated to the point of volatilization was struck with the face of a hammer coated with sugar melted upon it and made to adhere by moisture, a detonation took place. A still more powerful detonation was produced as follows:—Upon an anvil a disc of paper of three inches in diameter was laid, covered with pulverized sugar: over the sugar was placed another similar disc, covered with pulverized nitre: a bar of iron rather wider than the discs at a welding heat was then held over them, and subjected to a blow from a sledge. An explosion with a report like that of a cannon ensued.

Instructed by the facts and considerations above stated, it is inferred that the explosions which contributed to extend the conflagration in New York, as above mentioned, arose from the reaction of the nitre with the combustible merchandise with which it was surrounded. It is presumed that as soon as the fire reached any of the gunny-bags it must have run rapidly through the whole pile, by means of the interstices necessarily existing between them, the nitre with which they were imbued causing them to deflagrate. Much of the salt being thus brought to the temperature of fusion, it must have run about the floor, reached the combustibles, and soon found its way to the next story, through the scuttles which were open. All the floors must have been rapidly destroyed by the consequent deflagration, far exceeding in activity any ordinary combustion. Meanwhile, the nitre being all liquefied and collected in the cellar in a state of incandescence, and the merchandise conglomerated by the fusion of sugar and shellac, aided by the molasses, the weight, the liquidity, and temperature, must have produced all the conditions requisite to intense detonations. The floors having been consumed, the store must have been equivalent to an enormous crucible of twenty feet by ninety, at the bottom of which were nearly 300,000 lbs. of nitre, superficially heated far above the temperature producible by any furnace, so as to convert the reagents into nascent aëriform matter under a pressure of half a million of pounds. The intense reaction, however, would not permit of durable contact. At each impact the whole mass must have been thrown up explosively, and hence the successive detonations. But the chemical reaction, the heat, and the height of the fall, growing with their growth, and strengthening with their strength, the last elevation was succeeded by the thundering report and stupendous explosion of which it has been an object to afford satisfactory explanation.

William Harrison Pickering, of Liverpool, merchant, for improvements in evaporating brine and certain other fluids. Patent dated March 20th, 1849; six months.—(Communication.)

RESEARCHES ON THE BILE OF THE OX.

By M. A. STRECKER.

Few substances have been the subject of such numerous researches as the bile. Since the publication of M. Demarçay's essay on the bile chemists have generally agreed in regarding this organic fluid as a species of soap, essentially constituted by the soda salt of a peculiar acid, to which the name of *cholëic acid* has been assigned.

Berzelius combated this opinion. According to him the principal element of the bile is a neutral substance, called by him *biline*, and the several acids which chemists have successively found in the bile or formed with this liquid are simply products of the decomposition of the bilin.

The results of the researches of Liebig, Theyer, Schlosser, Verdeil, and others have altogether negatived this view of Berzelius; and it appears clearly demonstrated now that the principal organic element of the bile possesses the characteristic properties of an acid.

On the other hand, however, it has been equally established that the constitution of the bile is by no means so simple as Demarçay assumed it to be. In a former essay on the composition of this organic fluid M. Strecker endeavoured to demonstrate that the bile contains two organic acids, of which the one contains nitrogen but no sulphur, the other both nitrogen and sulphur; to the former he gave the name of *cholic*, to the latter that of *cholëic*, acid.

M. Strecker subsequently studied the metamorphoses of cholic acid, and endeavoured to establish the composition of cholëic acid, which latter, however, he has not yet succeeded to isolate completely. The present essay gives the results of his experiments, and the conclusions and speculations to which these results have led him.

DECOMPOSITION OF CHOLIC ACID BY ALKALIS.

When the solution of an alkaline cholate is boiled with potass, traces of ammonia are disengaged, and, upon the ensuing concentration of the liquid, an amorphous salt of potass is deposited. If the boiling be continued from twenty-four to thirty-six hours, with occasional additions of water, a crystalline deposit will be obtained by the concentration of the liquid. The aqueous solution of these crystals (which are, in the first place, to be freed from the liquid adhering to them by squeezing between folds of blotting-paper) yields with hydrochloric acid a white precipitate which unites into a soft and resinous mass. After some time this mass becomes solid and friable. It is now dissolved in a mixture of alcohol and ether; from this solution it is speedily deposited in crystals which possess all the characteristic properties of Demarçay's cholic acid, and which M. Strecker proposes to call *cholalic acid*.

The alkaline mother liquor filtered off from the crystals of the cholalate of potass holds a nitrogenous substance in solution. The extraction of this substance proving a task of too great difficulty when operating with potass, M. Strecker substituted for this alkali baryta. Having dissolved the cholic acid in baryta-water, he added to the liquor as much hydrate of baryta as it could dissolve upon ebullition, and kept the solution boiling for twenty-four hours. During this operation an insignificant trace of ammonia only is disengaged; the liquid remains perfectly transparent, and concretes upon refrigeration into a crystalline mass formed by a mixture of hydrate of baryta and cholalate of baryta. These two substances may be readily separated from each other by washing in boiling water; the cholalate of baryta, being less soluble than the hydrate, remains undissolved, at all events the greater part of it. But the portion which dissolves in the water need not be lost, but may be separated from the hydrate of baryta in the solution by transmitting through the latter a current of carbonic acid, and filtering. The carbonate of baryta formed remains on the filter, and the filtrate contains now simply cholalate of baryta. We have this salt here accordingly in two different states, viz., in solution, and in form of a sparingly soluble crystalline mass. To obtain the cholalic acid from this it is decomposed with hydrochloric acid, and the precipitate formed subsequently dissolved in boiling alcohol, after having been washed with cold water.

The nitrogenous substance which accompanies the cholalic acid is soluble in water; it will accordingly be found in the liquid from which the cholalic acid has been precipitated by the hydrochloric acid, and which holds also chloride of barium in solution. From this liquid the baryta is now precipitated by means of sulphuric acid; and the excess of the latter, and nearly the whole of the hydrochloric acid, are then removed by boiling the liquid with hydrated oxide of lead. The liquid is now again filtered, and the oxide of lead subsequently precipitated from the filtrate by means of sulphuretted hydrogen. The sulphuret of lead is removed by filtration. The filtrate yields upon evaporation prismatic crystals of glycocolle (sugar of gelatine).

It appears accordingly that the alkalis resolve the cholic acid into cholalic acid and sugar of gelatine.

This reaction may be represented by the following equation:—

$$\underbrace{C^{52}\,H^{43}\,NO^{12}}_{\text{Cholic acid.}} + H^2\,O^2 = \underbrace{C^{48}\,H^{40}\,O^{10}}_{\text{Cholalic acid.}} + \underbrace{C^4\,H^5\,NO^4}_{\text{Glycocolle.}}$$

Properties of Cholalic Acid.

Cholalic acid crystallizes generally in tetrahedrons, rarely in octahedrons with square base. The crystals are colourless, brilliant, and friable. In dry air they lose a little water, and their surface becomes dull. They taste rather bitter, with a slightly saccharine aftertaste. They require for their solution 750 parts of boiling and 4,000 parts of cold water. Boiling alcohol dissolves them readily; from a saturated solution in this menstruum the cholalic acid recrystallizes upon cooling. 1,000 parts of cold alcohol of 70 Cent. dissolve 48 parts of cholalic acid. Addition of water to the alcoholic solution turns the liquid milky, and, if the latter is then kept standing at rest for some time, brilliant needles are formed in it, intermixed usually with tetrahedric crystals. One part of cholalic acid dissolves in 27 parts of ether; the ethereal solution deposits, by spontaneous evaporation, transparent and colourless rhomboïdal tables.

The composition of the tetrahedric crystals, and of the octahedric crystals with square base, is represented by the formula:—

$$C^{48}\,H^{40}\,O^{10} + 5HO.$$

At 212° Fahr. these crystals lose 9.9 per cent. = 5 equivalents of crystallization water.

The acid crystallized in the rhombic system contains:—

$$C^{48}\,H^{40}\,O^{10} + 2HO,$$

and loses at 212° Fahr. only one equivalent of water. The crystalline needles which are obtained upon the addition of water to the alcoholic solution of cholalic acid have the same composition, and lose equally only one equivalent of water at 212° Fahr.

There exist, accordingly, different modifications of cholalic acid. These modifications M. Strecker compares to those of the cholic acid, which he has described in his former essay under the names of *cholic*, *paracholic*, and *amorphous cholic* acids.

When cholalic acid is heated to 383 Fahr. it fuses into a transparent liquid, and loses 2.2 per cent. = 1 equivalent of water. The fused liquid concretes upon cooling into a resinous mass which possesses all the characteristic properties of Demarçay's choloïdic acid:—

$$\underbrace{C^{48}\,H^{40}\,O^{10}}_{\text{Cholalic acid.}} = \underbrace{C^{48}\,H^{39}\,O^{9}}_{\text{Choloïdic acid.}} + HO.$$

At 572° F. cholalic acid loses 7.3 per cent. of water, and is converted into dyslysine:—

$$\underbrace{C^{48}\,H^{40}\,O^{10}}_{\text{Cholalic acid.}} = \underbrace{C^{48}\,H^{36}\,O^{6}}_{\text{Dyslysine.}} + H^4\,O^4$$

This transformation of cholalic acid, first into choloïdic acid, and finally into dyslysine, is equally effected by protracted ebullition with hydrochloric acid.

Cholalates.

Cholalic acid dissolves copiously in dilute solutions of the alkalis and in ammonia. With the aid of heat it decomposes the alkaline carbonates, with disengagement of carbonic acid. Upon evaporation of the neutral solutions obtained, the alkaline cholalate is deposited in crystals. On spontaneous evaporation at the common temperature, the salt remains behind in the form of an amorphous varnish.

It dissolves readily in alcohol, and crystallizes from the alcoholic solution on evaporation.

An aqueous solution of cholalate of potass containing three per cent. of cholalic acid presents the following reactions:—

With chloride of barium it yields no precipitate; however, on concentrating the solution to a certain extent a flocculent deposit is obtained.

With chloride of calcium the liquor concretes into a gelatinous mass. The addition of a few drops of ether determines, after some time, the formation of crystalline needles.

With acetate of copper the solution yields a bluish-white precipitate.

With the salts of mercury it yields white precipitates, which redissolve partially upon ebullition.

With nitrate of silver it yields a white precipitate, which likewise redissolves partially upon ebullition.

M. Strecker has analyzed the cholalates of potass, baryta, and lime.

The cholalate of potass crystallizes in fine needles. Its composition is expressed by the formula:—

$$C^{48}\,H^{39}\,O^{9},\,KO.$$

The cholalate of baryta is sparingly soluble in water, and separates upon evaporation in crystalline pellicles.

Its composition is expressed by the formula:—

$$C^{48}\,H^{39}\,O^{9},\,BaO.$$

The cholalate of lime is very sparingly soluble in water.

Its composition is expressed by the formula:—

$$C^{48}\,H^{39}\,O^{9},\,CaO.$$

DECOMPOSITION OF CHOLIC ACID BY THE ACIDS.

Cholic acid dissolves in concentrated hydrochloric acid (and also in concentrated sulphuric acid).

When the solution of cholic acid in hydrochloric acid (or in sulphuric acid) is boiled, the liquid becomes turbid, and deposits oily drops, which subsequently, upon cooling, become solid and resinous. This deposit possesses the characteristic properties of a feeble acid. It contains:—

$$C^{52}\,H^{41}\,NO^{10}$$

or

$$C^{52}\,H^{39}\,NO^{8},$$

according as the ebullition has been continued for a longer or shorter period of time. The resinous bodies resulting from the first action of the hydrochloric or sulphuric acids upon the cholic acid differ accordingly from the latter simply in this, that they contain respectively 2 and 4 equivalents of water less:—

$$C^{52}\,H^{43}\,NO^{12} - 2HO = C^{52}\,H^{41}\,NO^{10}$$

$$C^{52}\,H^{43}\,NO^{12} - 4HO = C^{52}\,H^{39}\,NO^{8}.$$

If the ebullition be continued after the separation of the oily drops, the latter will at length solidify; the products of this long-continued action of hydrochloric acid upon cholic acid are in this case choloïdic acid and glycocolle:—

$$\underset{\text{Cholic acid.}}{C^{52}\,H^{43}\,NO^{12}} + HO = \underset{\text{Choloïdic acid.}}{C^{48}\,H^{39}\,O^{9}} + \underset{\text{Glycocolle.}}{C^{4}\,H^{5}\,NO^{4}}$$

The choloïdic acid itself is finally decomposed by the action of the hydrochloric acid, and converted into dyslysine:—

$$\underset{\text{Choloïdic acid.}}{C^{48}\,H^{39}\,O^{9}} = \underset{\text{Dyslysine.}}{C^{48}\,H^{36}\,O^{6}} + 3HO$$

Choloïdic Acid.

Pure choloïdic acid is solid, white or yellowish, and friable. It melts in boiling water. In the dry state it fuses only above 302° Fahrenheit. It dissolves readily in alcohol. The alcoholic solution reddens litmus paper; the choloïdic acid is precipitated from it by water.

Choloïdic acid dissolves only with very great difficulty in ether, which precipitates it also from its solution in alcohol, and supplies, accordingly, a ready means to effect its purification.

The composition of choloïdic acid is represented by the formula:—

$$C^{48}\,H^{39}\,O^{9}.$$

It is perfectly anhydrous, and does not even contain an equivalent of basic water. It decomposes the alkaline carbonates, with disengagement of carbonic acid.

The composition of the choloïdate of baryta is expressed by the formula:—

$$C^{48}\,H^{39}\,O^{9},\,BaO.$$

Dyslysine.

This body, which results from the long-continued action of hydrochloric acid upon choloïdic acid, presents itself, in a state of purity, in the form of a resinous mass of a whitish-grey colour. It dissolves readily in ether, but is precipitated again from the ethereal solution by alcohol. It is insoluble in water and cold alcohol, and very sparingly soluble in boiling alcohol. It is equally insoluble in ammonia and solution of potass.

These properties distinguish the dyslysine very clearly from choloïdic acid, and enable us to effect the separation of these two substances from each other with great facility.

CHOLEÏC ACID.

The cholic acid, the metamorphoses of which we have described in the preceding paragraphs, constitutes one of the elements of the precipitate (cholate of lead) obtained by treating the bile of the ox with acetate of lead. If, after having removed this precipitate by filtration, subacetate of lead be added to the filtrate, another copious deposit will be obtained. This new precipitate differs in composition from the first precipitate; the numbers found upon analysis show that this second precipitate is, in fact, a mixture of two distinct salts of lead. The one of these salts is the basic cholate of lead, the other is a salt of that metal with *choleïc* acid. This latter acid contains both nitrogen and sulphur. M. Strecker has not succeeded in his efforts to isolate it completely, but he has endeavoured to fix its composition in an indirect manner.

With this view he has studied the products of the decomposition which the mixture of cholic and choleïc acids suffers by the action of alkalis. The products of the decomposition of cholic acid by the alkalis being perfectly well known, no difficulty had to be encountered in distinguishing from them those resulting from the decomposition of the choleïc acid, and of which the examination might be expected to throw some light on the constitution of the latter acid.

After having decomposed the mixed cholate and choleate of lead by water of baryta, M. Strecker boiled the resulting soluble baryta salts in water containing an excess of hydrate of baryta. The reaction being brought to a close by means of an analogous treatment to that which we have described when speaking of cholic acid, he found in the residue the following products:—Cholalic acid, glycocolle, and taurin. This seems to demonstrate that the cholic and choleïc acids suffer by the action of alkalis an analogous metamorphosis, the former of the two acids being resolved into cholalic acid and glycocolle, the latter into cholalic acid and taurin. We may, accordingly, assume that these two acids have an analogous composition, and assign to the choleïc acid a formula such as will enable us to explain its resolution into cholalic acid and taurin.

The formula which M. Strecker proposes is:—

$$C^{52}\,H^{45}\,NO^{14}\,S^{2}.$$

Adding to the elements of this formula 2 equivalents of water, we have the elements of 1 equivalent of taurin and 1 of cholalic acid:—

$$\underset{\text{Choleïc acid.}}{C^{52}\,H^{45}\,NO^{14}\,S^{2}} + H^{2}\,O^{2} = \underset{\text{Cholalic acid.}}{C^{48}\,H^{40}\,O^{10}} + \underset{\text{Taurin.}}{C^{4}\,H^{7}\,NO^{6}\,S^{2}}.$$

Let it be borne in mind here that the cholic acid equally requires the accession of two equivalents of water to be converted into cholalic acid and glycocolle. The formula proposed for the choleïc acid by M. Strecker has been verified, moreover, by numerous analyses of choleate of lead of greater or less purity.

Choleates.

The choleates have not been prepared in a state of purity by M. Strecker. This chemist has been enabled, however, to study some of the characteristic properties and reactions of these salts by operating upon fish bile, which contains only traces of cholic acid. On the other hand, M. Strecker has succeeded to procure from the bile of the ox mixtures very rich in choleïc acid, by repeatedly precipitating the alcoholic solution of the bile with ether, and redissolving in alcohol the first portions of the precipitate, which are richer in choleïc acid than the latter.

The alkaline choleates are very soluble in alcohol and in water, but insoluble in ether; they are neutral to litmus-paper. They are highly higroscopic, but not deliquescent. Their aqueous solutions have a very saccharine taste, with bitter aftertaste. Their solutions are not precipitated by acids, not even by concentrated sulphuric acid; but if the acidified liquid be now boiled it will become turbid, and after some time deposit oleaginous drops of choloïdic acid; the mother liquor filtered off from this deposit contains taurin.

Choleate of potass is completely precipitated from its aqueous solution by concentrated potass and carbonate of potass. The salts of lime, baryta, magnesia, and the acetate of lead fail to precipitate the aqueous solution of choleate of potass. Subacetate of lead precipitates it in white flakes, which speedily unite into an emplastic mass, but disappear again upon ebullition of the liquid or upon addition of subacetate of lead in excess.

Acetate of copper, nitrate of silver, and bichloride of mercury fail to precipitate the aqueous solution of choleate of potass. Sesquichloride of iron produces a precipitate which redissolves again upon addition of the reagent in excess. Protonitrate of mercury and protochloride of tin produce white flakes in an aqueous solution of choleate of potass.

The aqueous and the alcoholic solutions of the choleates may be evaporated in the water-bath without these salts suffering alteration. But the same cannot be said of the solution of choleïc acid, such as it is obtained by treating the choleate of lead with sulphuretted hydrogen: this solution is decomposed by the process of evaporation, leaving a residue behind which dissolves only partially in water.

When the solution of a choleate is heated in conjunction with sugar and sulphuric acid, the liquid acquires an intense violet-red tint—a reaction analogous to that which cholic acid presents under the same circumstances.

At the conclusion of his most interesting paper M. Strecker points out the analogies of properties and composition which exist between cholalic acid, lithofellic acid, and certain acids extracted from the lichens, such as lichesteric acid and rocellic acid.—*Annalen der Chemie und Pharmacie*, vol. lxvii., page 1, and *Journal de Pharmacie et de Chimie*, February, 1849.

ON THE PROTOGINE OF THE ALPS.

By M. DELESSE.

Protogine usually contains five different minerals, viz., quartz, orthose, oligoclase, mica (with a large proportion of iron), and a variety of talc. In the protogine of Mont Blanc the whole of these five metals are present; in other varieties of protogine they are very unequally

distributed, and one or more of them are frequently found altogether wanting. Yet those varieties of protogine which are composed of only three or four of the minerals usually constituting that rock still retain the same character as if the whole of the five component minerals were present. We must look upon them accordingly as formed under the same circumstances with the original rock, and constituting simply varieties of the latter.

QUARTZ.

This is one of the most important elements of protogine, as it is of all granitic rocks. In rocks of clearly-characterized granitic structure we find the quartz of the paste sometimes indistinctly crystallized. Generally, however, the quartz of the paste is hyaline, of a grey or violet colour. In some veins it is found in crystals of some centimetres in thickness; in this case it is seldom reddish or violet, but mostly of a deepish black colour, and belongs to the variety called smoky quartz.

It would appear, however, that the darker colour of these crystals is not owing to the presence of a larger amount of colouring matter, but is attributable simply to the thickness of the crystals, since, when the latter are broken into fragments of the common thickness of the grains of quartz or the paste of the rock, these fragments present the usual reddish, greyish, or violet colour of quartz.

The colour of quartz is derived entirely from some volatile organic matter, and the crystals may be rendered perfectly white and transparent by slight calcination, by which process they lose only about twelve thousandths of their weight.

The colouring matter of the quartz is not volatile *in vacuo* at common temperatures: it will persist in the quartz, though the latter be kept for several days over sulphuric acid in the exhausted receiver of an air-pump, or digested, hot or cold, in hydrochloric acid and ammonia. This resistance to the influence of chemical and physical agents is most probably attributable, at all events in a great degree, to the intimate intermixture of the organic matter with the mineral particles.

ORTHOSE.

This mineral generally presents a white or greyish-white colour; sometimes, however, we find it fawn or rose coloured, or of a pale scarlet. It has a brilliant pearly lustre. Orthose is also found sometimes of a red or brownish-yellow colour, which two tints denote incipient decomposition.

According to Saussure, the density of orthose is 2.615.

The crystals of this mineral are often several centimetres long; they are well formed, and generally possess the characteristic macle which is common to them in granitic rocks.

The specimens of orthose, oligoclase, and mica which M. Delesse analyzed were taken from an enormous block well known at Chamouni, and which had fallen from the needles above the Mer de Glace.

The crystals of the orthose were greyish-white, with a shade of fawn colour.

The analysis gave:—

Silica	66.48
Alumina	19.06
Lime	0.63
Peroxide of iron	traces
Magnesia	traces
Potass	10.52
Soda	2.30
	98.99

OLIGOCLASE.

Protogine, like the greater number of granites, contains another felspar besides orthose. In the case of protogine this second felspar is oligoclase. The colour of this mineral is white, resembling greatly that of orthose, with which latter oligoclase may, therefore, be confounded. If it be borne in mind, however, that orthose is translucent, whilst oligoclase is rather opaque, or inclines slightly to a greenish hue, a mistake of this kind will not readily occur. Oligoclase is characterized, moreover, by parallel microscopic striæ, and the crystals are often complex and macled, like those of the albite of Carlsbad.

The density of oligoclase is 2.633.

The oligoclase analyzed by M. Delesse was taken from the same block which had furnished the orthose. The crystals were very pure.

The analysis gave:—

Silica	63.25
Alumina	23.92
Peroxide of iron	traces
Oxide of manganese	traces
Lime	3.23
Magnesia	0.32
Soda	6.88
Potass	2.31
	99.91

These figures nearly correspond to those found by MM. G. Rose and Rammelsberg in their analysis of the oligoclase of Warmbrunn, in Silesia.

MICA.

The mica which protogine contains is a more or less deep green colour, and has little or no lustre. When calcined in an open crucible it acquires a reddish-bronze colour, with brilliant reflections. Upon calcination in a close crucible it acquires a blackish-green colour.

When the mica of protogine is in very thin laminæ the mere action of the air suffices to impart a bronze colour to it; this is a characteristic property which may serve to guide us in the recognition of that mineral, and in distinguishing it from other similar substances.

The density of the mica of protogine is 3.127, which is much greater than that of the micas of granites. The superior density of the protogine mica is unquestionably owing to the large quantity of oxide of iron which that mineral contains.

The crystals of the protogine mica have the form of small irregular hexagonal prisms, with the edges not perpendicular to the bases.

The edges of small laminæ of protogine mica are rounded with difficulty before the blowpipe. When the mica is treated with fluxes in the blowpipe flame the presence of iron and manganese is clearly indicated; in phosphate of soda it dissolves entirely in the flame of the blowpipe.

The protogine mica is perfectly acted upon by hydrochloric acid, and the silica separates in the form of flocculi. The facility with which this mica is acted upon is most probably owing to the large proportion of iron which it contains.

The crystals which M. Delesse analyzed were taken from the same block that had equally furnished the orthose and oligoclase.

The analysis gave:—

Silica	41.22
Alumina	13.92
Peroxide of iron	21.31
Protoxide of iron	5.03
Protoxide of manganese	1.09
Lime	2.58
Magnesia	4.70
Potass	6.05
Soda	1.40
Fluorine	1.58
Water and loss by heat	0.90
	99.78

TALC.

The variety of talc which protogine contains, and which is distributed through that rock in very small contorted laminæ, has a pearly lustre. The colour varies from celadon to emerald and pale greyish green. Upon calcination it acquires in some instances a brownish tint, in others a bright nut-brown colour, with golden reflections; whereas pure talc upon calcination acquires a very slightly yellowish silver-white colour.

The protogine talc is not elastic; its hardness is rather greater than that of even pure talc. Like the latter, it scratches glass after calcination.

Very thin laminæ of talc, extracted from various specimens of protogine, were tried in the blowpipe flame; at a very high temperature their edges were rounded without suffering exfoliation, and the fused portion was coloured by iron. This property of the protogine talc had been already observed by Saussure. Other varieties of talc, on the contrary, exfoliate without fusing, when exposed to the action of the blowpipe flame. The fusibility of the protogine talc, and the brown colour which it acquires by calcination, clearly indicate that it contains a larger proportion of iron than is contained in common talc.

Besides these five minerals, protogine may, according to the observations of MM. Dufrenoy and E. de Beaumont, contain accidental admixtures of hornblende, sphène, iron pyrites, garnets, and serpentine.

Some veins of protogine contain fluor spar, oligiste iron, sulphuret of molybdenum, &c. In l'Oisan we find albite, rutile, anatase, brookite, &c. In some veins, apparently contemporaneous with the rock, and usually formed of quartz, we find epidote and that variety of chlorite to which M. G. Rose has given the name of ripidolite, and which is also found in the paste of protogine. —*Annales de Chimie et de Physique*, January, 1849.

ON THE PREPARATION OF VITRIFIABLE PIGMENTS.

By Dr. A. WÄCHTER.

[*Concluded from page* 231.]

BLACK AND GREY COLOURS FOR PAINTING PORCELAIN.

IRIDIUM BLACK.

The fine grey powdered iridium, as obtained commercially from Russia, is mixed with an equal weight of calcined chloride of sodium, and heated to a faint redness in a porcelain tube, through which a current of chlorine is passed. A portion of the iridium is in this manner converted into bichloride of iridium and sodium, which is dissolved out of the ignited mass with water. The aqueous solution of the double salt is evaporated to dryness with carbonate of soda, and afterwards extracted with water, which furnishes black sesquioxide of iridium. The latter is dried, and mixed with twice its weight of lead-glass (12 parts minium, 3 parts white sand, 1 part calcined borax, fused together), and ground on a plate of glass. The undecomposed iridium remaining, after the first treatment with chlorine and seasalt, is resubmitted to the same treatment.

IRIDIUM GREY.

One part of sesquioxide of iridium, 4 parts of oxide of zinc, and 24 parts of lead-glass (5 parts of minium, 2 parts of sand, and 1 part of calcined borax, fused together) are intimately mixed, and finely ground on a plate glass. The iridium pigments, when burnt in upon porcelain, present, on examination with the microscope, the appearance of sesquioxide of iridium, as suspended in the transparent lead-glass. In consequence of the unchangeability of the sesquioxide of iridium, it may be mixed with every other vitrifiable pigment without injuriously affecting its tints, a property not attaching to any other grey or black pigment used in porcelain painting.

BLACK FROM COBALT AND MANGANESE.

Two parts of sulphate of cobalt deprived of its water of crystallization, 2 parts of dry protosulphate of manganese, and 5 parts of nitre are well mixed, and heated to redness in a hessian crucible until the whole of the nitre is decomposed. The mass when calcined is exhausted with boiling water, when it furnishes a deep black powder, consisting of a combination of cobalt and oxide of manganese. 1 part of this compound is mixed with 2½ parts of lead-glass (5 parts minium, 2 parts sand, and 1 part calcined borax, fused together), and ground on a glass plate.

GREY FROM COBALT AND MANGANESE.

Two parts of the compound of oxide of cobalt and manganese are mixed and ground fine with 1 part of oxide of zinc and 9 parts of lead-glass

(5 parts of minium, 2 parts of sand, and 1 part of calcined borax, fused together). The pigments described in this and the last section are much more economical than those from iridium, and at the same time not inferior in colour. They do not, however, combine so well with other colours, and their tints vary somewhat on repeated bakings. When these colours are examined by the microscope the oxide of cobalt and manganese are discovered not dissolved by the lead-glass, but suspended in it.

GROUND BLACK

is a very infusible black for painting, and is not acted on by the overlying colours on fusion. It consists of 5 parts of blue violet (gold-purple), $1\frac{2}{5}$ part of oxide of manganese and cobalt, and $1\frac{2}{5}$ part of oxide of zinc, mixed, and finely ground on a glass plate.

WHITE FOR COVERING.

One part minium, 1 part white sand, and 1 part crystallized boracic acid, are intimately mixed, and fused in a porcelain crucible. This enamel forms a colourless clear glass when suddenly cooled, as, for instance, when poured into water; whereas if left to cool slowly it remains perfectly white and opaque. On heating the clear, colourless glass to its melting point it regains its opacity. This property is common to it with the enamels produced by tungstenic and arsenic acids; opacity in the present case is, perhaps, due to the separation of silicate of lead, as in the white enamels by oxide of zinc, or arseniate or tungstate of potash. It is so excessively minute that under microscopes of the highest powers the glass merely exhibits a yellowish turbidity, in which no distinct particles are visible. This white is useful for marking the lighter parts of pictures where the exposure of the bare white porcelain surface would be insufficient for this purpose. When mixed in a small quantity with the green and yellow pigments it renders them more easy to be employed in covering.

LEAD FLUX.

This is a colourless lead-glass, employed for touching up any parts of the painting which may have remained dull, and for mixing with pigments not otherwise easy of fusion. It is prepared by mixing together 5 parts of minium, 2 of white sand, and 1 of calcined borax.

RED AND BROWN PIGMENTS PREPARED FROM PEROXIDE OF IRON.

YELLOW RED.

Anhydrous sulphate of the peroxide of iron is heated to redness on a dish in an open muffle, and stirred with an iron spatula until the sulphuric acid is so far expelled that a sample mixed with water on a plate of glass exhibits a fine yellowish-red colour; the peroxide of iron is freed from any undecomposed sulphate by washing, after which it is dried. The pigment is prepared by mixing 7 parts of this yellow-reddish peroxide with 24 parts of lead-glass (12 parts of minium, 3 parts of sand, and 1 part of calcined borax, fused together), and ground on a plate of glass.

BROWN RED.

If the process for the expulsion of the sulphuric acid from the persulphate of iron be carried further than in the last-described operation, the residue will exhibit a dark red colour, well adapted for a brownish-red pigment. It is prepared in the same manner as described for the yellow red.

BLUE RED (POMPADOUR).

On heating the persulphate yet more strongly it is deprived of its loose consistence, becomes denser, and takes a bluish-red colour. To intervene at the precise moment when the oxide of iron has not acquired the carmine tint is difficult, from the rapidity with which the colours change at this high temperature. To prepare the pigment, 2 parts of the purple-coloured peroxide of iron are mixed with 5 parts of lead-glass, obtained by fusing 5 parts of minium, 2 of sand, and 1 of calcined borax.

CHESNUT BROWN.

This colour, of all shades, even to black, is obtained by raising the heat of the persulphate of iron to yet higher degrees. The pigment is prepared by mixing 2 parts of the chesnut-brown peroxide with 5 parts of lead-glass, prepared by fusing 12 parts of minium, 3 of sand, and 1 of calcined borax.

CHAMOIS.

One part of the hydrate of the peroxide of iron, prepared by precipitating the peroxide of iron with ammonia, is mixed with 4 parts of the lead-glass described in the preceding, and ground on a plate of glass. The colour is used very thin, and serves to produce a yellowish-bronze brown.

FLESH COLOUR.

One part of red peroxide of iron, 4 parts of dark yellow (II.), and 10 parts of lead-glass prepared as described under chesnut brown, are well mixed, and finely ground upon a glass plate. This pigment must only be employed in a thin layer. It is susceptible of various tints by mixing with red peroxide, sky blue, or the dark yellow (II.). On examining the porcelain into which these colours have been burnt, the peroxide is seen suspended unaltered in the clear lead-glass; at least if any is dissolved in the lead-glass the quantity is so small as to be imperceptible.

BROWN PIGMENTS FOR PORCELAIN PAINTING.

LIGHT BROWN (I.).

Six parts of dry protosulphate of iron, 4 parts of dry sulphate of zinc, and 13 parts of nitre are heated to redness in a crucible until the nitre is wholly decomposed. When the mass has cooled the crucible is broken, the residue removed, and separated from the soluble matters by boiling with water. A combination of oxide of zinc with peroxide of iron remains as a yellowish-brown powder. The pigment is prepared by mixing 2 parts of this compound with 5 parts of lead-glass prepared by fusing 12 parts of minium, 3 of sand, and 1 of calcined borax.

LIGHT BROWN (II.).

Two parts of dry sulphate of iron, 2 of dry sulphate of zinc, and 5 of nitre, are treated in the same manner as the foregoing. The compound of oxide of zinc and iron has a lighter tint; the pigment is prepared from it as the preceding.

LIGHT BROWN (III.).

One part of dry sulphate of iron, 2 parts of dry sulphate of zinc, and 4 parts of nitre, are treated as the foregoing.

When the light brown colours have been burnt in upon porcelain, they possess, under the microscope, the appearance of transparent particles of the yellowish oxide of iron suspended in colourless lead-glass.

BISTER BROWN (I.).

One part dry sulphate of manganese, 8 parts dry sulphate of lime, 12 parts dry sulphate of iron, and 26 parts nitre, are treated as directed for light brown (No. I.), and the dark brown powder produced is mixed with $2\frac{1}{2}$ times its weight of lead-glass, compounded as for light brown (No. I.).

BISTER BROWN (II.).

One part dry sulphate of manganese, 4 parts dry sulphate of iron, 4 parts dry sulphate of zinc, and 12 parts nitre, are treated as the preceding. The product is of a somewhat darker tint.

SEPIA BROWN (I.).

One part dry sulphate of iron, 1 part dry sulphate of manganese, 2 parts dry sulphate of zinc, and 5 parts nitre, are treated as directed for light brown (No. I.). A greyish-brown pigment is thus obtained, which is mixed with $2\frac{1}{2}$ times its weight of a glass of the composition in light brown (No. I.).

SEPIA BROWN (II.).

One part of calcined sulphate of iron, 2 parts of calcined sulphate of manganese, and 6 parts of calcined sulphate of zinc are treated as for the former sepia brown.

DARK BROWN.

One part of dry sulphate of cobalt, 4 parts of sulphate of zinc, 4 parts of dry sulphate of iron, and 10 parts of nitre, are mixed and treated as directed under light brown (No. II.). A beautiful dark reddish-brown combination of the oxides of cobalt, zinc, and iron results, which is mixed with $2\frac{1}{2}$ times its weight of the same lead-glass as the preceding colours.

CHROME BROWN.

One part of hydrated peroxide of iron is closely mixed with 2 parts of the chromate of protoxide of mercury, and heated to redness in a dish in an open muffle, to expel the whole of the mercury. The dark reddish-brown compound of the oxides of chromium and iron is mixed with 3 times its weight of lead-glass, prepared by fusing 5 parts of minium, 2 parts of sand, and 1 part of calcined borax. Examination of these brown colours under the microscope demonstrates that they are merely suspended in the lead-glass, and not dissolved. It will be found a cheaper, as well as a more certain, method to prepare the coloured combinations of the oxides in the dry way for the colours which constitute the pigments than to precipitate the mixed solutions by carbonate of soda, and calcining the precipitates, as may be done. If the oxides were mixed with the lead-glass in a separate instead of a combined state, the colour would be impure, and after the firing would exhibit the tints in a thick and thin layer; the colours before and after the firing would be totally different, and the artist would thus be deceived.*—*Liebig's Annalen*, January, 1849.

ON A SERIES OF ORGANIC ALKALIS IN RELATION WITH AMMONIA.

By A. WURTZ.

The history and theory of the ammoniacal compounds have always been regarded with great interest as these compounds are, in a manner, a medium of communication between inorganic and organic chemistry. Ammonia, the most simple and most powerful of organic bases, would be the type of that large class of bodies but for one important fact, to which, however, an undue value has been assigned, viz., that it contains no carbon. In my opinion this difference is not sufficient to separate it from the organic bases; indeed I have succeeded in converting this alkali into a true organic compound, and that without depriving it of one of its properties as a powerful base, or even its odour, by adding the elements of the hydrocarbon C_2H_2. By adding to NH_3 the elements of 1 equivalent of methylene, C_2H_2, the compound C_2H_5N, which I call methylic ammonia, is produced. By adding the elements of ethylene, C_4H_4, to ammonia, ethylic ammonia, C_4H_7N, is obtained. The compound bodies C_2H_5N and C_4H_7N may be regarded as methylic ether, C_2H_3O, and ordinary ether, C_4H_5O, the equivalent of oxygen being replaced by an equivalent of amidogen, NH_2; or they may be viewed as ammonia in which 1 equivalent of hydrogen is replaced by methylium, C_2H_3, or ethylium, C_4H_5. The following representation exhibits the relation subsisting between these substances and ammonia:—

H_3N, ammonia.	NH_2, H, *hydramide.*
C_2H_5N, methylic ammonia.	NH_2, C_2, H_3, *methylamide.*
C_4H_7N, ethylic ammonia.	NH_2, C_4, H_5, *ethylamide.*

The names ethylamide and methylamide will be employed throughout this paper to designate the two new bases. The two substances are produced under three different circumstances—by the action of potash on cyanic ethers, by the action of potash on cyanuric ethers, and by the action of potash on the ureas. A few formulæ will best exhibit these reactions:—

$$\underbrace{C_2NO,HO}_{\text{Cyanic acid.}} + 2KO + 2HO = 2CO_2, KO + \underbrace{H_3N}_{\text{Ammonia.}}$$

* Liebig has examined the whole of the colours described in the above article, and pronounced them superior in most instances to those generally produced.

$C_2 NO, C_2 H_3 O + 2KO + 2HO = \left\{ \begin{matrix} C^2 H_5 N \\ 2CO_2, KO + \end{matrix} \right.$

Cyanate of methylene. Methylamide.

$C_{10} NO, C_4 H_5 O + 2KO + 2HO = \left\{ \begin{matrix} C_4 H_7 N \\ 2CO_2, KO + \end{matrix} \right.$

Cyanic ether. Ethylamide.

Since cyanuric acid and the cyanuric ethers are isomeric with the cyanic compounds, it will suffice to multiply the preceding formula by 3 to explain the second mode of formation. It only remains to speak of the ureas; the subjoined equations will exhibit the manner in which they give rise to these bases :—

$C_2 H_4 N_2 O_2 + 2KO + 2HO = 2CO_2, KO + H_3 N + H_3 N$

Urea.

$C_4 H_6 N_2 O_2 + 2KO + 2HO = 2CO_2, KO + H_3 N + C_2 H_5 N$

Acetic urea.

$C_6 H_8 N_2 O_2 + 2KO + 2HO = 2CO_2, KO + H_3 N + C_4 H_7 N$

Metacetic urea.

Hydrochlorate of Methylamide.—This salt was obtained by boiling cyanurate of methylene with an excess of potash in an apparatus arranged so that the vapours of methylamide may pass into a refrigerator and be condensed in a receiver containing pure water. The exceedingly caustic liquor thus obtained has a strong odour of ammonia, of which alkali it contains, however, not a trace, for when saturated with hydrochloric acid and evaporated to dryness the residue, which consists of hydrochlorate of methylamide, dissolves immediately in hot alcohol. The salt on cooling crystallizes in beautiful laminæ, iridescent while they float in the liquid, and assuming a nacreous appearance when dry. They gave on analysis :—

Carbon	17.4	2=12	17.7
Hydrogen	8.7	6= 6	8.8
Chlorine	52.2	1=35.5	52.5
Nitrogen	21.7	1=14	21.0

Hydrochlorate of Methylamide and Chloride of Platinum.—In beautiful golden scales, which dissolve in hot water, and contain $ClH, C_2 H_5 N Pt Cl_2$. They gave on analysis :—

Carbon	5.3	2= 12	5.0
Hydrogen	2.8	6= 6	2.5
Chlorine	44.4	3=106.5	44.9
Platinum	41.4	1= 98.6	41.5
Nitrogen	..	1= 14	6.1

Nitrate of Methylamide.—In beautiful transparent prisms, which dissolve in alcohol.

Hydrochlorate of Ethylamide.—I have obtained this substance both with cyanic and cyanuric ether. It dissolves in absolute alcohol, and crystallizes in laminæ; its melting point is below 212°, and on cooling it solidifies into a crystalline mass. On distillation with burnt lime it gives off ethylamide in the form of an exceedingly caustic liquid, which has a very strong odour of ammonia, and which precipitates all the metallic salts, and even those of magnesia. In solutions of salts of copper it forms at first a blue precipitate, which afterwards again dissolves to an azure-blue liquid; in salts of nickel it produces a green precipitate, which does not redissolve as ammonia does. The liquid did not contain a trace of ammonia, as I satisfied myself by saturating it with hydrochloric acid; the residue, after drying, dissolved entirely in absolute alcohol, and with chloride of platinum formed a double salt. The composition of hydrochlorate of ethylamide is represented by the formula $ClH, C_4 H_7 N$. On analysis the salt gave :—

Carbon	28.9	29.4	4=24	29.4
Hydrogen	9.9	9.9	8= 8	9.8
Chlorine	43.7	..	1=35.5	43.6
Nitrogen	17.5	..	1=14	17.2

Hydrochlorate of Ethylamide and Chloride of Platinum crystallized in gold scales, soluble in water. Analysis gave :—

Carbon	9.5	4= 24	9.5
Hydrogen	3.2	8= 8	3.2
Chlorine	42.0	3=106.5	42.4
Nitrogen	..	1= 14	5.7
Platinum	39.0	1= 98.6	39.2

I trust soon to be able to give a complete history of these alkalis.—*Comptes Rendus*, Feb. 12, 1849.

ANALYSES OF FELSITE, OLIGOCLASE, AND MUROMONTITE.

By M. KERNDT.

FELSITE.

M. Kerndt analyzed crystallized green felsite from Bodenmais. The density of the crystals was 2.5465.

The analysis gave :—

Silica	63.657
Alumina	17.271
Potass	10.659
Soda	5.134
Lime	0.394
Magnesia	2.281
Protoxide of iron	0.451
Protoxide of manganese....	0.153
	100.000

OLIGOCLASE.

The oligoclase analyzed was taken from Boden, near Marienberg, in the Erzgebirge.

Its density was 2.66 to 2.68.

The analysis gave :—

Silica	61.958
Alumina	22.658
Potass	3.079
Soda	9.432
Lime.	2.025
Magnesia	0.104
Peroxide of iron	0.348
Peroxide of manganese ...	0.396
	100.000

MUROMONTITE.

This is the name given by M. Kerndt to a certain ceriferous mineral which is met with in the environs of Manersberg, near Marienberg, in the Erzgebirge. It is found in black grains, which have a greenish reflection.

Its density is 4.263 to 4.265.

The analysis gave :—

Silica	31.089
Yttria	37.140
Glucina	5.510
Alumina	2.230
Oxide of lanthanium	3.530
Oxide of cerium	5.540
Protoxide of iron	11.230
Protoxide of manganese ...	0.900
Lime	0.710
Magnesia	0.420
Soda	0.650
Potass	0.170
Water	0.820
	99.939

—*Journal de Physique et de Chimie.*

HINTS TOWARDS A CLASSIFICATION OF COLOURS.

By Professor J. D. FORBES.*

To classify and describe colours is not so easy a matter as it might at first sight appear to be; and yet it is of very considerable interest, as well scientific as artistical. It is impossible that this shall be completely done until we understand far better than at present the cause of the colours of bodies, natural or artificial. Had Newton's explanation of these colours been as satisfactory as it was for the phenomena of the solar spectrum, the classification of colours would be more simple and obvious than it is. My present object is to treat the subject not at all as a matter of art, neither as to the effect which colours produce in painting as an imitative art, nor as to the chemical art of producing and combining pigments; but simply as a matter of description and nomenclature, so that the objective effects of varied tints and hues may be referred to some standard classification of colours and their modifications. I shall then state what progress I have made in forming such a standard suite of colours.

* Communicated by the author to "The Philosophical Magazine," having been read before the Royal Society of Edinburgh, December 4, 1848, and January 15, 1849.

I am unable, and have not the intention, to give a complete history of the principles and methods adopted at different times for classifying and compounding colours for the use of the painter, and in imitation of natural hues which probably exhaust all which art can succeed in producing. For what I shall now state I am in part indebted to the ingenious essay of the profound Lambert, called "Beschreibung einer Ausgemahlten Farbenpyramide."

Pliny, in describing the pigments used by the most famous painters in their pictures, mentions four, which, according to Lambert, were white, ochre-yellow,* red, and black; and he supposes that a bluish tint may have been obtained by diluting the black and white. Leonardo da Vinci, himself a painter of the first order, appears to have had clear ideas on the subject of the formation of compound colours from their simplest elements; and although he reckons six, namely, white, yellow, green, blue, red, and black, yet it is scarcely to be supposed that he was not aware that green could be compounded of yellow and blue, and, therefore, we may probably admit that he regarded blue, red, and yellow as the primary colours, to be mixed with white or black according to the degree of shadow in which they are to be represented.

Waller, in the Philosophical Transactions for 1686, attempts a classification of colours and pigments, proceeding upon the basis (which appears to be there assumed as generally admitted) that red, yellow, and blue are the sole primary colours. This paper was originally accompanied by a diagram of hues, which is, however, wanting in the copies which I have examined.

Newton's discovery of the composition of white light was, of course, an important step in the theory of the composition of colours generally; although that apparent paradox did not fail to introduce some difficulties into the explanation of the action of pigments, which have not unnaturally affected the views of persons accustomed to regard the subject solely as one of art, and at the same time to complicate it somewhat by the introduction of seven colours in the complete spectrum, red, orange, yellow, green, blue, indigo, and violet. Perhaps it is not too presumptuous to say, that but for some peculiar respect for the number seven, and more particularly from a fancied analogy between the spaces occupied by the colours and the musical intervals, Newton would not have classed blue and indigo as distinct colours, in which case we may consider that the Newtonian spectrum consists of the three primary colours, red, yellow, and blue, and the three secondary, orange, green, and purple. Newton was perfectly aware that by combining the primary colours, such as yellow and blue together, a green, not distinguishable from that of the spectrum except by its refrangibility, will be formed; and he also observed the effect of combining three or more coloured rays, which generally tend to a more or less perfect whiteness, though it does not appear that Newton ever actually formed white light by the partial combination of certain rays of the spectrum. For he states (Prop. VI., p. 136, edit. 1730) expressly, "I could never yet by mixing only two primary colours produce a perfect white. Whether it may be compounded of a mixture of three taken at equal distances in the circumference [of the figure of a circular spectrum which he is describing] I do not know; but of four or five I do not much question but it may. But these are curiosities of little or no moment to the understanding of the phenomena of nature. For in all whites produced by nature there uses to be a mixture of all sorts of rays and by consequence a composition of all colours."

Every optician knows Newton's empirical rule for the estimation of the colour produced by the mixture of any number of the elementary colours of the spectrum and in any proportions. But it is necessary here to repeat it, because it would appear to simplify the scale of colours

* Silaceus, the word translated ochre-yellow, is of very doubtful signification.

much indeed, were colours only such as the composition of the coloured rays of light present. Imagine a circle drawn whose centre is pure white, and its circumference presents in order all the colours of the spectrum in succession, and occupying arcs proportioned to their lengths in the true spectrum, the two ends of the spectrum, or the extreme violet and red, coalescing at one place.* Let these colours pass gradually, by the mixture of white light, from their intensest development at the circumference to perfect whiteness at the centre of the circle. Suppose it were required to find the effect of mixing two parts of green, one of red, and one of violet. At the circumference of the circle, and at the centre of the green space, describe a small circle whose area is 2; at the middle points of the red and violet describe circles whose areas are 1; find the centre of gravity of the three circles: it will be found on the diagram over the tint which the mixture of rays, if actually formed, will present.

Since the quantity of colour in any mixture is to be regarded in this arbitrary construction as applied at the centre of the arc appropriated to each colour, and since no two such points are directly opposed to one another in the circle, it follows by construction (as M. Biot has remarked) that a perfect white cannot be compounded out of only two colours in the spectrum. This corresponds with Newton's experience, that such a colour (the mixture of two opposites) "shall not be perfectly white, but some faint anonymous colour." But these experiments merit well a careful repetition, which I am not indeed aware that they have ever received; and it is very probable that Newton never made them with a pure, or even an approximately pure, spectrum.†

But Newton's celebrated experiment of mixing together coloured powders until he obtained a perfectly indefinite grey is most to our present purpose. He describes in the fifteenth experiment of the second part of his first book of Optics the various dry pigments which he employed, the most effective of which was a mixture of orange, purple, green, and blue, which "became of such a grey or pale white as verged to no one of the colours more than to another" (p. 131), which when powerfully illuminated by the sun was an exact match for a pure white paper less perfectly illuminated. The reason why it does not appear absolutely white under ordinary circumstances Newton thus explains:—

"All coloured powders do suppress or stop in them a very considerable part of the light by which they are illuminated. For they become coloured by reflecting the light of their own colours more copiously and that of all other colours more sparingly, and yet they do not reflect the light of their own colours so copiously as white bodies do." [This he illustrates by illuminating red lead and white paper with the red ray; the white paper appears the more brilliantly red of the two.] "Therefore, by mixing such powders [powders, namely, of various colours], we are not to expect a strong and full white, such as is that of paper, but some dusky obscure one, such as might arise from a mixture of light and darkness, or from white and black, that is, a grey, or dun, or russet-brown, such as are the colours of a man's nail, of a mouse, of ashes, of ordinary stones, of mortar, of dust and dirt in the highways, and the like."

Whatever may be thought of Newton's theory of the colours of natural bodies (which refers them to the colours of thin plates), the reasoning of the above paragraph will hardly be questioned. There will, therefore, be always this essential difference between compounding rays of the spectrum and compounding pigments, that in the former case, by throwing light of two or more colours upon a white screen, each of these colours being reflected with equal vividness, the brightness of the screen will be the sum of the brightnesses due to the several rays (and if a sufficient number of rays be combined the result will be a dazzling white); but, on the other hand, by combining pigments we do not add together lights, but merely construct a ground or screen capable of scattering a greater number of the constituents of a beam of white light which falls upon it. Thus there will be an inevitable quantity of darkness or absorbent faculty in the constitution of every artificial colour, whatever be its predominant reflecting hue; and the mixture of pigments will not tend to increase the brightness, as the mixture of lights would do, but only to mix with the fundamental darkness of the surface a portion of light which shall be of a mixed instead of a simple hue.

Let us suppose for a moment a simple case. Let us admit that a paper thickly coated with ultramarine can reflect none but blue rays, and that a paper coated with chrome-yellow reflects only yellow rays. But further than this, a share of the blue and of the yellow light falling on each is absorbed; suppose one half to be thus lost. If a compound pigment of blue and yellow be formed and exposed to the same white ray as before, we cannot expect that it should have more brilliancy than either one or other of the primitive colours, whilst it is evident that the union of rays of yellow and blue light upon a white screen would have a twofold splendour.* For we must admit the reflecting particles in each of the separate pigments to be so densely spread that a ray of light can fall nowhere, on the ultramarine for instance, but it finds a particle of colour ready to decompose and reflect it, and the same of the pure yellow pigment; in a mixture, therefore, of the two, the surface may be regarded as equally divided amongst an infinite number of the blue and the yellow reflecting points, so that the reflected light is half yellow, half blue, but altogether is no more than the amount which either pigment covering the whole surface would have reflected. We must not, therefore, suppose that by mixing pigments we render the surface on the whole more reflective, that is to say, more luminous, than before. Experience confirms this anticipation. On the whole, then, in this experiment, half the light is still absorbed and half of the remainder is yellow, the rest blue, constituting a green colour.

Similar reasoning will hold true of any number of separate colours combined into one; and as, perhaps, no pigment reflects only one pure colour of the spectrum, the mixtures will always be more compound than they are assumed to be, and give hues of always increasing impurity.

The process of mixture cannot in any case be expected to improve the power of reflecting the pure colours residing in the constituent pigments. It is much more likely to deteriorate it, which will tend to give a tone of always less absolute brightness to more complex colours.

The process of mixing pigments may often affect their relative strength, especially if moisture be used. There may be a mutual action, which will cause an undue preponderance of one or other constituent. These difficulties have constantly been felt by those who have endeavoured to compound colours from their elements.

We have assumed above that the reflective power of pigments of different colours is the same. But this does not appear to be the case. The ingenious experiments of Lambert, which though probably but rough approximations are yet valuable as such, inform us that the whitest surface reflects $\frac{4}{10}$ths of the white incident rays, and king's yellow almost as much of rays of its own colour: but the brightest red (cinnabar) reflects but $\frac{1}{3}$rd of its own coloured light, and a blue surface (mountain Berlin blue) but $\frac{1}{7}$th of the blue rays.

On these principles we may expect that if the circumference of a wheel be painted with stripes of red, yellow, and blue, alternating with one another, so that the extent occupied by these colours shall be in certain determinate proportions, the mixture shall appear white, or rather neutral grey, the wheel being put in rapid rotation. We can estimate the illumination of the surface compared to that of white paper in the following manner.

The proportional extent of the surfaces may be found by direct experiment, or otherwise thus. By Newton's rule of compounding colours, we may deduce that a white compounded of red, yellow, and blue, must consist of 38.6, 19.6, and 41.8 rays out of 100 of these colours respectively; for the centres of gravity of the red, yellow, and blue sectors make angles of 91° 54'.5 between the red and yellow, 115° 26' between the yellow and blue, and 152° 39'.5 between the blue and red. In order that the centre of gravity of the whole shall coincide with the centre of the circle, the primary colours must be in proportion to the sines of those angles, which are .9785, .9031, and .4593; the first being blue, the second red, and the third yellow, which give the proportions above stated. And there can be little doubt that this rule is sufficiently correct, though we restrict the colours of the spectrum to three only; for the centre of gravity of the blue (for example) may be regarded as the centre of gravity likewise of the blue contained in the green, and that in the indigo and violet; and so of the other colours.

Let, then, the proportions 0.386=R, 0.196=Y, 0.418=B, represent the constituents of white light in the spectrum, their sum being=1. But, by what has been said of Lambert's experiments, it appears that red, yellow, and blue pigments reflect but $\frac{1}{3}$rd, $\frac{4}{10}$ths, and $\frac{1}{7}$th of the rays of those respective colours which fell upon them. Therefore, to have reflected light of the same composition with the white of our tricoloured spectrum, we must have the surfaces of the colours larger in proportion as their reflecting power is less. Hence the spaces in our coloured wheel must be:—

Red	3R	or	$1.157=r$.
Yellow ...	$\frac{10}{4}$Y	or	$0.490=y$.
Blue	7B	or	$2.927=b$.
The sum of these			$4.574=n$.

Consequently, of all the red rays which fall upon our tri-coloured surface only the fraction $\frac{1}{3}\cdot\frac{r}{n}$ are reflected (for of those which fall on the yellow and blue spaces, none are reflected, and but one third of those falling on the red), that is,

$\frac{R}{n}$ or .0843

Of the whole yellow rays are reflected $\frac{Y}{n}$ or .0429

Of the whole blue rays are reflected $\frac{B}{n}$ or .0914

In short, the reflected light is white light, whose intensity is attenuated by reflection n or 4.57 times; whereas, had it been incident on white paper, it would have still had $\frac{4}{10}$ths of its first brightness, or been attenuated only 2.50 times. This abundantly explains why the result

* The limits of the several colours will occur, according to the Newtonian proportions, at the following angles in a continued graduation:—

	° ′
Red begins at	0.0
Orange	60.46
Yellow	94.57
Green	149.38
Blue	210.23
Indigo	265.4
Violet	299.15

† If Newton's circular figure was intended (which, however, M. Biot questions) to be divided according to the accurate proportions of the colours in the spectrum, it would be a matter of great difficulty to assign the due proportions to the extreme red and violet; any variation in this respect would alter the character of the diametrically opposed tints, and make a perfectly white compound of two tints possible, or the reverse. It is hardly necessary to add here, that the perfect white produced by the complementary tints which occur in experiments of depolarization arises from the mixture of colours of a very complex constitution.

* What is meant here by speaking of rays of different colours having "equal" or "twofold" brilliancy will be explained by and by.

is a grey colour, not a bright white.* The proportions of the surfaces of bright colours whose mixture produces white (r, y, b in the preceding notation) is 5, 3, and 8, as given by Field.

It is to Mayer, the mathematician, that we owe a complete and perfect diagram of mixed colours, starting from red, yellow, and blue as constituents. Let the extreme corners of a triangle be painted of these colours, and let the periphery of the triangle be composed of graduating colours between each pair of these respectively; then the centres of the sides of the triangle will be occupied by perfect orange, perfect green, and perfect purple, each of which will pass in each direction towards the predominating primary colour. The periphery of Mayer's triangle includes, therefore, all the colours of the spectrum, or primary colours, mixed two and two. But combinations of three colours may be represented by selecting points in the interior of the triangle which shall be the centre of gravity of the constituent colours.

The unit of mass for any primary colour or pigment is the proportion which, mixed with the other two primaries, forms a perfectly neutral grey. This must be found by experiment, and resembles the atomic weight or equivalent of the simple bodies of chemistry. Lambert found it by uniting carmine and gamboge until a perfect orange was formed, which (judging by the eye) inclined neither to red nor yellow; so with yellow and blue forming green, and with blue and red forming purple. The quantities being weighed in each case, two such experiments were sufficient to determine the relative powers of the colours, but the third was used to confirm them. He thus found the combining proportions by weight of carmine, gamboge, and Berlin blue, to be 1, 10, and 3.†

We are now to consider how far this triangle carries us towards a complete scale of colours. It is manifest that the intensity of the colours depends upon the reflective power of the pigments used, and that this essentially varies for the different primary colours. In no sense, then, can we be said to have red, yellow, and blue, of equal brightness at the corners of our triangle; for even if we assume as merely convenient definition that by equal brightness of different colours we mean the proportions in which, when combined, white light results, we have already seen that the yellow pigment, being far most reflective, will be brightest, then the red, and after all the blue. But in fact we have no scale at all for comparative brightness of heterogeneous colours. We must take the pigments purest in quality, and most lucid or reflective as regards the quantity of light which they scatter, and consider these as the primary colours. The mixed colours also vary in their lucidity, according to the prevalence of a more or less lucid component; the yellow hues will be most lucid, the blue least.

When the triangle is exposed to a brighter light the proportions of the colours remain unchanged, and the whole will be more lucid.

It is probable, however, that the decomposing action of all pigments upon light is limited; and that a coloured surface may be so drowned in white light that much of the light is returned undecomposed, and the colour is thus diluted.

If less light fall on the triangle, a different kind of dilution occurs: only pure coloured light will be reflected, but so little of it as to affect the eye but slightly, or not at all, with the sense of colour.

In the latter case all colours pass into indistinguishable blackness, in the former case into indistinguishable whiteness.

If we mix black and white pigments with coloured pigments, we may have both these variations exhibited at once under a common external illumination.

If we have a series of triangles thus constructed, they will embrace under one common illuminating influence (as ordinary daylight) all possible varieties of hue and shade under that illumination. Every conceivable natural or artificial object, such as a piece of stuff, a feather, or a flower, ought to be capable of being matched with one or other of the spaces in these triangles. This is all that we propose to accomplish. If we choose the most lucid known bodies for our primary colours, we shall be sure to have none to match which are not included in our suite.

The question now arises of the number of intermediate mixed colours which can be interpolated between any two primary or simpler colours, so that each may be distinguishable by the eye upon a close comparison. The number is much smaller than might be supposed. Lambert states that from perfect black to perfect white he could only trace thirty intermediate shades distinguishable by the eye under the most favourable circumstances possible. The number of gradations of even the most positive colours is probably considerably less, and of the more neutral colours much less again; at least if we do not repeat those semi-neutral compounds which are indistinguishable from one another.

As to the transition from one quality of colour to another without regard to its dilution with light or shade, as, for instance, from red to blue, the sensible intermediate stages are also probably much fewer than might be suspected. Mayer affirms that the distinction of mixed colours is evident so long as the sum of the component parts does not exceed twelve. Thus a bright yellow, such as king's yellow, being denoted by y^{12}, yellow ochre is $y^{10} r^2$, umber is $y^6 r^3 b^3$, ivory black $y^2 r^3 b^7$, in all which cases the sum of the parts is equal to twelve. Upon this scale it is easy to show that the fundamental triangle, whose side is thirteen, will contain ninety-one coloured spaces. These embrace all possible combinations of colour, of the fundamentally greatest intensity which the imperfection of our pigments enable us to procure.

Allowing four gradations of each colour into blackness, and four into whiteness, Mayer reckoned 819 colours in all; a number which will certainly appear small considering the apparent infinity of hues and shades. It is probably sufficient, however, for matching any colour by reference to two others, one above and the other below it, in any of the scales; and such subdivision may probably be carried by the eye to greater accuracy than one intermediate step. The gradation of nine steps from perfect black to perfect white through any colour is, perhaps, too small; but, on the other hand, the neutral colours, as already observed, some of them at least, lose their distinguishable characters compared with one another, when diluted either with black or with white, but especially the former.* Taking advantage of this consideration, Lambert modified Mayer's triangles by reducing them continually in size and in the number of elements, as the standard colours approached white on the one hand and black on the other; forming thus a double pyramid, whose common base was Mayer's triangle, the colours vanishing into white at one apex and into black at the other.† A triangular pyramid or tetrahedron of thirteen elements in the side would contain 455 elements, and the double pyramid or hexahedron 910 elements.

Other writers have attempted to adopt primary colours different from red, yellow, and blue; and with this subject has been mixed up the inquiry into the actual composition of the solar spectrum, which, though not immediately connected with it, may be mentioned in passing. Mayer maintained not merely that all colours whatever may be formed by the combination of red, yellow, and blue, but that in reality these colours alone exist in the solar light, which he inferred by looking through a prism at a black spot on a white ground, an essentially faulty mode of operating. But later, Dr. Wollaston came to the conclusion that the solar spectrum is composed of four colours only, namely, red, green, blue, and violet, without any gradations in the quality of the colour. Dr. Young, finding experimentally that "the perfect sensations of yellow and of blue are produced respectively by mixtures of red and green, and of green and violet, light," assumes that the primary colours are red, green, and violet;—a singular opinion, which appears to rest on no particular evidence further than the disjunction of the red and violet rays at the two ends of the spectrum, and which has met with no support any more than that of Abbé Nollet, who maintained the primary qualities of orange, green, and purple. In truth no synthetical experiment can give any sure countenance to one or other of these views; for the fact that red and green combined in certain proportions produce yellow admits of equally sound interpretation by supposing that, the green being a compound of yellow and blue, the whole of the blue and a part of the yellow combine with the red to produce a perfect white, which then dilutes the outstanding portion of the yellow; and in like manner a perfect purple mixed with perfect green must make a perfect blue diluted with a perfect white. Analysis, however, where possible, must lead to more conclusive results; and Sir David Brewster considers that the orange, green, and purple of the spectrum are really composed of two, if not three, colours each. The analysis he employs is the absorbing power of media, for these colours are (as is well known) undecomposable by refraction.

Various attempts have been made to carry out Mayer's principle of compounding colours from red, yellow, and blue, and some elaborate attempts have been made to obtain model suites of colour. I shall at present only refer to Mr. D. R. Hay's ingenious work called "Nomenclature of Colours," which he has illustrated by a very large number of selected hues and shades all compounded from red, yellow, and blue, variously diluted with black and white, which, from Mr. Hay's skill in the choice and use of colours, are probably as pure and vivid as we can expect to produce in the present state of art. It is unnecessary here to speak of the taste and skill with which the harmony and contrasts of colour are used and illustrated in the plates to his work.

As a mere classification of colours, Mr. Hay's work does not adopt the simplest form; nor is the nomenclature, I conceive, by any means free from objection. It would be difficult, for instance, to refer any required colour to its place in a complete system of hues and shades by merely looking over Mr. Hay's plates. The specimens which have the closest affinity are often widely separated; but then the object, a purely artistic one, was different from ours. The mixtures used by Mr. Hay in his gradations of colour were made, I understand, by the eye, and not by weight; but an experienced eye will, perhaps, make a gradation at least as good as a quantitative one. The dilutions with white (or tints, as Mr. Hay calls them) appear to be less perfect in this respect.

The primary colours in Mr. Hay's work are red, yellow, and blue, or those which occupy the angles of Mayer's triangle. They are composed of carmine, chrome-yellow, and French ultramarine.

The secondary colours, or orange, green, and purple, with their gradations into their component primaries, exhaust all the combinations

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* Goethe, in his "Theory of Colours," seems to think that he has overturned Newton's experimental demonstrations by calling the opinion that "all the colours mixed together produce white" "an absurdity which people have credulously been accustomed to repeat for a century in opposition to the evidence of their senses." (Eastlake's translation, p. 225.) The truth is, that "grey" is not an affection of light at all, but of surface merely. All light combining the coloured elements in due proportion is essentially white, though more or less intense, but no surface can be said to be perfectly white rather than grey, except by comparison with another. A surface of white paper illuminated by common daylight is grey relatively to a similar one placed in full sunshine.

† Farbenpyramide, § 63.

* I suspect, indeed, that in some instances the dilution of the semi-neutrals with white renders them more easily distinguished, but only down to a certain point.

† In the coloured plate accompanying Lambert's work we find only the pyramid of colour diluted with white, which he seems to have considered sufficient in practice, § 39. In reality, however, the shades or mixtures with black are indispensable components of such a system.

two and two of the primaries, embracing all the colours of the spectrum, and are represented by the exterior row of colours in Mayer's triangle.

The combination of colours by three at a time leads to more complexity, and the advantage of Mayer's system is here most evident. Mr. Hay, following Field, calls tertiary colours those produced by a union of the secondaries; thus:—

Orange and green form citrine,
Orange " purple " russet,
Purple " green " olive.

"Their distinctions arise from a double occurrence of yellow in the first, of red in the second, and of blue in the third." In like manner, by the combination of the tertiary colours (or primary hues, as Mr. Hay calls them), he produced a system of quaternaries (or secondary hues), and so on until the small predominance of any one or two primary colours in the compound reduces the whole to a neutral grey.

[*To be continued.*]

THE CHEMICAL TIMES.

SATURDAY, MARCH 31, 1849.

OUR OWN SERIES.*

No. VII.

ON CHEMICAL MANIPULATION.

INDIARUBBER AND GUTTA PERCHA—

(*Continued*).

INSTEAD of employing for the purpose of connecting tubes the small cylinders of indiarubber which we have already described, it is sometimes more advisable, indeed imperative, to effect the connection by tightly winding around the tubes to be joined a narrow strip of sheet caoutchouc. To select an example: it very often happens that two tubes having already been connected by an ill-made indiarubber cylinder, the seam of the latter opens soon after heat has been applied, and thus renders the whole apparatus leaky; under these circumstances the best method of procedure consists in enveloping the joint with a strip of caoutchouc in the manner to be described. A ribbon or strip of caoutchouc, having been cut off of a proportionate size to the tube to be enveloped, is held before the fire until it becomes very soft, but not melted in the least degree. It is now gently to be moistened on each side with oil of turpentine, and held to dry for a few seconds before some source of heat. Thus prepared, it will be found to have become remarkably adhesive, and capable of adhering to another similarly prepared surface with such an intimate union that a perfect junction results. The method of winding this prepared sheet scarcely requires comment. We should remark, however, that during the act of circumvolution the strip should be pulled out or extended slightly, so that the resulting elastic force thus developed shall suffice, without pressure, for bringing the two surfaces into absolute and certain union.

This manner of employing indiarubber, although extremely useful in some instances, should never be had recourse to when the plan of union by short indiarubber tubes or cylinders can be effected. The universal employment of such strips, indeed, bespeaks a certain kind of laziness, and a slovenly mode of chemical research. Our readers who are much in strange laboratories will not fail to have seen many operators who, for want of necessary caution at the commencement of operations, perpetually recur to the indiarubber sheet, and ply the scissors with an assiduity that might provoke envy in the breast of a tailor. Such a practice bespeaks a crude, ill-regulated, slovenly mind; and will usually be associated with little better in the shape of chemistry than wild speculations, clumsy hypotheses, and, at the best, a shrewd guess now and then.

In all operations where indiarubber has to be exposed for a long time to a temperature above 120° F., it is never safe to rely upon the occlusive power alone of this substance. True, it does not become melted until far above the temperature we have indicated, still less decomposed. Nevertheless it is rendered so soft, tender, and yielding, that a very slight force of gaseous or liquid pressure suffices to expand it into bubbles, or to otherwise destroy the adjustment.

Under these circumstances it is by no means proper to rely upon a mere reinforcement of the same substance without other aid. The original danger would thus be sure to revive after a time: the evil moment would only be slightly procrastinated. The best aid under these circumstances is a compound of indiarubber and cloth, or silk, the one supplying strength, the other tenacity.

The compound here indicated is an analogue of the waxed paper generally found in laboratories, than which it is, for the generality of purposes, a much better substance.

As the basis of operations for the preparation of this substance, we have generally been in the habit of employing fine jean, such as is used by staymakers; but a substance equally good, perhaps better, though considerably more expensive, is a piece of stout silk; for instance, a ribbon. Whatever the textile fabric, it should be laid evenly, with as little stretching as possible, upon a flat surface, and nailed down at the corners. A layer of indiarubber solution already described is now to be laid on as evenly as possible with a spatula or the finger. This operation, simple to describe, is nevertheless difficult to be performed in such a manner that a perfectly even surface shall result. Indeed it is in a manner almost impossible to accomplish this so as to satisfy an eye fastidious in these matters; nevertheless the result will be good. A layer being thus imposed, the surface should be exposed to a temperature of about 80° F. for the space of an hour, and then a second layer is to be added with the same precaution; afterwards a third layer, which when dry, the tissue is to be turned about and treated in the same way on the other side. Thus prepared, it is to be stored for use in a roll or scroll, with a piece of paper interposed in such a manner that the two surfaces of the tissue shall not come into contact, which if allowed to occur, so strong an adhesion would result that the two could not be separated without injury to both.

A tissue thus prepared is not only possessed of strength and adhesiveness, but also of a considerable amount of elasticity, if care have been taken as directed not to extend the tissue when laying it flat on the cloth, beyond the amount absolutely necessary to obliterate the folds. This material may be used with great effect, either instead of caoutchouc, or with more propriety as an external reinforcement to the latter, when employed in operations involving a prolonged application of heat.

* Continued from page 177.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

William Sager, of Rochdale, in the county of Lancaster, wool-dealer, for certain improved means and apparatus for effecting the transit or conveyance of goods, passengers, and correspondence, by land or water, and for other such purposes; part or parts of which means and apparatus constitute a new and improved method of generating steam, which improvement is applicable to other purposes to which steam is generally applied as a motive power. Patent dated September 15th, 1848. Enrolled March 12th, 1849.

This specification relates, first, to certain novel means and apparatus for generating steam. The improved generator has large tubes or channels, of an elliptical or other convenient form, running its whole length, and secured by flanges or other suitable means to its outer casing, which latter forms a cistern or reservoir for the feed water; similar but smaller tubes run parallel with the larger ones; besides these tubes, several channels or vessels for containing water run also the whole length of the boiler; the under surfaces of these vessels are concave; they are pierced perpendicularly, for the passage of the smoke and atmospheric draught to the main chimney; at the top of the boiler plates of iron are placed between tubes, in a longitudinal direction, so as to confine the smoke to the flues; the admission of air is regulated by means of an aperture furnished with a door. Grids or grates are placed vertically between the upper elliptical tubes, to prevent the top of the said tubes from becoming red hot. The smaller tubes which run parallel with the latter have their upper surfaces protected by a cap or covering of iron, made solid or hollow; this covering may be made also of fire-clay. A large covered vessel is placed on the top of the main body of the boiler; flues communicate through this vessel vertically with the main chimney. The feed water is supplied from the outer cistern or reservoir by means of one or more force-pumps placed in any convenient position, having branch pipes communicating with all the various steam generators in the boiler; these pipes run through the centre of the tubes; they are pierced on the under sides with small holes, so that the water may be distributed around the tubes. By this means it will be seen that the feed water may be injected in small streams upon the red-hot iron; or the tubes can be kept partially filled with water. The steam is conveyed from the tubes through pipes either at once to the steam-engine, or to an intermediate receiver or reservoir, whence it may be carried off for the purposes for which it may be required. As safety-valves may be necessary, these may be fixed in any convenient position, with glass gauges at the ends of each of the steam generators; both the steam and feed pipes are fitted with stopcocks, so that, in case of accident or otherwise, the communication can be cut off from any one tube without in any way deranging the working of the boiler.

Secondly. To certain novel arrangements of machinery for the propulsion, drawing, and steering vehicles, for passengers, goods, or correspondence, upon ordinary roads, the motive power, in all cases, being steam. The first locomotive carriage described consists of a steam generator or boiler, mounted with a framing upon ordinary running wheels; the engine itself being fixed by straps upon a second frame,

mounted upon a shaft running in a longitudinal direction, and revolving in bearings on the ends of the carriage-frame. This shaft also carries the driving-wheel, which is driven by a connecting-rod and crank in the ordinary manner. The driving-wheel is divided or sliced vertically into four parts; the peripheries of the two inner parts are cut at right angles towards the inner sides, the outer part of the peripheries being bevilled off, which bevil is continued outward upon the two outer parts of the driving-wheel. It will be thus seen that the whole of the working part of the engine, with the driving-wheel, can vibrate or swing upon the horizontal shaft before mentioned. So long as this shaft be retained in its proper position, the driving-wheel remains vertical, and upon the flat part of its periphery the carriage will be propelled in a direct line; but if the shaft be made partially to revolve in its bearings, by any suitable mechanical arrangement, the bevilled parts of the periphery of the driving-wheel will come in contact with the ground, and the carriage will describe a curve according to the amount of bevil on the wheel. It would be necessary that the end of this revolving shaft be near the steam generator, and made hollow, with a telescope joint, for the passage of the steam to the cylinders.

In one of the engravings which accompany the specification a modification for steering the carriage is shown, where the cylinders are mounted upon the main framing; the driving-wheels being mounted upon a shaft revolving in bearings also on the main frame. In this case the front pair of wheels are small. Upon the axle of these wheels is mounted a framing centred upon a pin, in the manner of the wheels of an ordinary coach.

Another mode is described by the patentee for the impulsion of carriages by means of steam on the common roads. This is effected by the attachment of levers (acting as legs upon the ground) jointed to the extreme ends of the piston-rods, the ends of the levers or rods coming in contact with the ground, and pushing the carriage forward in a reverse direction to the travel of the piston. A modification is shown where the ends of the levers are attached to the rings or clips of the eccentrics, instead of the piston-rod. This method of impulsion the patentee proposes to apply also to boats or vessels on canals and rivers, the levers in this case being furnished with rollers, acting against the bed of the river, so arranged that in the backward travel of the legs the rollers revolve, whilst in the opposite direction they are held stationary by a rachet-wheel; or they may be lifted from the ground by inclined levers placed under them in their backward stroke.

Thirdly. To improvements in the construction of vessels or boats. These improvements consist in the adoption of a peculiar form or mould of the hull or body of the vessel; the lower part of the hull, instead of sweeping in any of the ordinary curved lines to the keel, is—after being curved inwards very abruptly from about the water line to about one fourth of the breadth of the upper decks—carried perpendicularly downwards to a considerable depth, so that the vessel sits almost flat upon the water; at the fore and after ends of the vessel this elongated lower part of the hull is tapered inwards to a sharp end. An arrangement is shown for placing the engines in a paddle-wheel boat of this construction. The cylinders are placed one on each side fore and aft the driving-shaft, and in an inclined direction towards the cranks.

Fourthly. To certain novel and improved means of aiding the impulsion of vessels at sea, with or without an auxiliary power. The improvements here consist in doing away with the masts for carrying the sails, and placing towards the head of the ship or boat a sheet of square-sail, distended by yardarms, and fixed by ropes at its lower extremity to the hull of the vessel, such sail being held up to the wind by the aid of one or more aërial balloons inflated with coal gas, or some other gas lighter than air; when not in use they are stowed inboard; the form of vessel previously described being well adapted for the reception of such balloons.

The claims are:—

First. For the improved means of and apparatus described for generating steam.

Secondly. For the various mechanical arrangements described for propelling, impelling, and steering vehicles for the transit of passengers, goods, and correspondence, on common roads.

Thirdly. For the peculiar form or lines described and explained for the construction of vessels, in contradistinction to the ordinary forms in use.

Fourthly. For the various methods, and the mechanical arrangements described, for propelling and impelling boats or vessels of any description on water; and also for the application of balloons to sustain the sails of vessels in the air in the manner described.

William Thomas Henley, of Clerkenwell, philosophical instrument-maker, and David George Foster, of Clerkenwell, aforesaid, metal-merchant, for certain improvements in telegraphic communication, and in apparatus connected therewith, parts of which improvements may be also applied to the moving of other machines and machinery. Patent dated August 10th, 1848. Enrolled February 10th, 1849.

This patent is described under eight different heads; distinct claims being made for each. The first part of the specification relates to telegraphic communication, which has exclusive reference to that description of communication derived from electric currents. The improvement consists in the employment of a needle or pointer, working before a dial-plate, such pointer being acted upon directly, and attached to a magnet placed within the sphere of influence of an electro or other magnet, the extremities of which are converted into two or more pairs of poles. Several arrangements for carrying out this improvement are shown in some of the engravings which accompany the specification, and without which a detailed description of the arrangements would be hardly intelligible.

The second part relates to a mode of retaining the magnetic bar, needle, or pointer, in one position, deflected or otherwise, for any length of time, and in the employment of the residual magnetism to retaining the magnetic bar, needle, or pointer, when brought back to its original position—that is to say, in moving or deflecting the pointer by the induced current, and bringing it back again by the aid of the reversed inductive current; by this means the movements of the needle can be made with much greater rapidity than heretofore.

The third part relates to the employment of an arrangement of magneto-electric apparatus, whereby two currents in opposite directions can be derived with the employment of one magnet, and either a single or double current can be made use of, as desired, to any point or station in the line of communication. Several arrangements of the electric apparatus for effecting this object are shown in the engravings which accompany the specification. In all these arrangements a magnet of the ordinary horseshoe form is used; this is placed in any convenient position; coils of wire, enveloping pieces of soft iron, are placed near to, but not in actual contact with, the poles of the magnet; the coils are centred upon spring levers. By this arrangement, when the buttons are pressed upon by the hand of the operator, or by some other mechanical means, the coils, with the pieces of soft iron, will be moved away from the action of the primary magnet, returning to their position as soon as released from pressure. Beneath the coils is placed a piece of iron which acts as an armature to the horseshoe magnet, the coils thus moving between the poles of the magnet and the armature. Another arrangement is shown in which the coils are suspended between the poles of the magnet, instead of being placed underneath. Attached to the armature are short circuit and reversing springs, to connect or break the metallic contact, but, such attachment being well understood in the ordinary electric telegraph apparatus, it is unnecessary here to describe it. A third arrangement is shown whereby the reversed is equally intense with the primary induced current; in this case the coils are placed below the poles of the electro-magnet; but in such a position that when moved the armature shall not be drawn away from the one pole until the opposite one is in contact. By this means the magnetic needle, or other recipient of the electric current, will be acted upon in opposite and equal currents.

The fourth part relates to the use of a mixture of gutta-percha with sand or finely-powdered glass for insulating or covering the metallic points or wires used in transmitting the electric currents. The mixture is composed of equal parts (by weight) of gutta-percha and sand pulverized in a mill until it be finer than the finest natural sand; or any description of glass ground equally fine, or the sweepings of glass-paper manufactories; the said glass or sand to be mixed with the gutta percha in a state of solution, or kneaded with it when in a plastic state.

The fifth part relates to the peculiar arrangement of a dial-plate, and a symbolic alphabet and code of numerals, to be expressed by a certain number of deflections of one or other, or both, of the magnetic needles or indicators, two being used—placed, when at rest, either in a horizontal line, vertical, and parallel to each other, or at any convenient angle, but having motion only in one direction.

The sixth part relates to the employment of a current-reverser, of a peculiar construction, whereby circuit currents of electricity may be obtained from voltaic batteries, such as are commonly used for the purpose of transmitting currents of electricity along metallic conductors, such reverser completing and breaking the current, so as to dispense with the use of the magneto-electric apparata before described. A description of this current-reverser would be hardly intelligible without the engravings which accompany the specification.

The seventh part relates to a mode of giving motion to timekeepers, and regulating them, by the aid of magneto-electro machines. This is effected by attaching to a hollow pendulum two coils of fine wire, surrounding the poles of two permanent horseshoe magnets, which induce the electricity, so that when the coils vibrate in the direction of their length with the pendulum they alternately come near to, but not in actual contact with, the opposite poles of the magnets. The two ends of the wire coils are carried through the hollow pendulum to a suitable recipient of the induced currents of electricity.

The eighth part refers to a mode of imparting motion to a train of wheel-work, with or without an auxiliary power, for the purpose of giving correct time, by means of magneto-electric machines or voltaic batteries, near or from a standard timekeeper at a distant station. In this case a very neat arrangement of wheel-work is used for regulating the clock by the induced electric currents in connection with a spring and fusee, only one hand being made use of instead of two to show the time upon the dial, the face of such dial being marked out as usual with the hours; between every two of the figures representing the hours are placed twelve minor marks indicating each the space of five minutes, so that the time may be read off with the same facility as with two hands. This arrangement the patentee also proposes to apply to all ordinary clocks. The spring and fusee may be dispensed with if desired, and motion given to the clock by currents derived from a voltaic battery. Two circuit-reversers of a peculiar construction for this purpose are described; the first is attached to the escape-wheel arbor, and consists of two brass segments, fixed round the arbor with ebony, or some other non-conductor, and connected with the arbor by means of small metal screws. Two brass flanges, fitted with platinum points, dipping in a cup of mercury, are also fixed to the arbor. The segmental pieces have

also platinum points, which dip into other cups of mercury, all of which are properly connected by wires with the battery. By this means it will be seen that at each revolution of the arbor the circuit will be completed twice, and twice broken. In the second arrangement the reverser is placed upon the pallet-arbor; it consists of two isolated arms placed across the arbor, one of which is in metallic connection with the arbor, and the other with a cup of mercury connected with the battery. The ends of these arms carry platinum points, which, as the pallet vibrates, alternately dip into the right and left hand cups of mercury, the cups being connected with each other by transverse wires.

The claims are:—

First. With respect to telegraphic communications, the peculiar arrangements and combinations described under the first head of the specification, in so far as regards the dividing of the poles of the electro-magnet into two or more pairs of poles, and the direct attachment of the magnetic bar, needle, or indicator, to the magnet, placed within the sphere of influence of the poles of the electro-magnet in the manner described in the specification.

Secondly. The patentee claims the mode of permanently deflecting the needle (for so long as may be desired), and the bringing back such needle to its original position by the reversed current, and there retaining it by the residual magnetism, both currents being of the same intensity.

Thirdly. He claims the three several arrangements described for producing two currents with the use of one magnet, whereby single or double currents can be sent, as desired, to a distant station.

Fourthly. He claims the application of a mixture of gutta percha with sand or finely-powdered glass for the isolation and protection of the conductors in any machines or machinery, motion to which is, or may be, given by currents of electricity.

Fifthly. He claims the code of visible symbols for telegraphic communication, as described and illustrated in the specification.

Sixthly. He claims the peculiar current-reverser described, as applicable to currents of electricity derived from a voltaic battery, such reverser completing the circuit twice during each depression, in the manner of the magneto-electric machines.

Seventhly. He claims the mode of giving motion to timekeepers from two permanent magnets, without the aid of soft iron; also the apparatus and machinery described for obtaining such motion.

Eighthly. He claims the mode of giving motion to machinery, and regulating it, by magneto-electric machines or voltaic batteries in the manner described and set forth; and also the peculiar combination and arrangement of the parts as described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MARCH 20TH, 1849.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman, for improvements in the manufacture of piled fabrics. Patent dated March 19th, 1849; six months.—(Communication.)

Joseph Béranger, of the firm of Béranger and Company, of Lyons, in the Republic of France, civil engineer, for improvements in weighing machines. Patent dated March 19th, 1849; six months.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals and alloys of metals. Patent dated March 19th, 1849; six months.

Samuel Hall, of King's Arms-yard, Coleman-street, in the city of London, civil engineer, for improvements in apparatus for effecting the combustion of fuel and consuming smoke, and for preventing explosions of steam-boilers and other accidents to which the boilers are liable. Patent dated March 19th, 1849; six months.

George Knox, of Moorgate-street, in the city of London, secretary to the Shrewsbury and Birmingham Railway Company, for improvements in railway carriages. Patent dated March 19th, 1849; six months.

Alexander M'Dougall, of Longsight, in the county of Lancaster, chemist, for improvements in recovering useful products from the water used in washing and in treating wool, woollen and cotton fabrics, and other substances. Patent dated March 20th, 1849; six months.

Charles William Siemens, of Birmingham, engineer, for certain improvements in engines to be worked by steam and other fluids, and in evaporating liquids. Patent dated March 20th, 1849; six months.

William Parkinson, of Cottage-lane, City-road, in the county of Middlesex, gas-meter manufacturer, successor to the late Samuel Crossley, for improvements in gas and water meters, and in instruments for regulating the flow of fluids. Patent dated March 20th, 1849; six months.

PATENTS RECENTLY EXPIRED.

R. Hill, Birmingham, merchant, for an improvement in door and other locks, and in staples used therewith. Patent dated March 18th, 1835; expired March 19th, 1849.

A. Smith, Belper, millwright, for a certain improvement or improvements in printing machines. Patent dated March 18th, 1835; expired March 19th, 1849.

H. W. Wood, London, merchant, for an improvement in obtaining certain oils. Patent dated March 18th, 1835; expired March 19th, 1849.—(Communication.)

J. Hunter, Arbroath, mechanic, for certain improvements in the art of cutting, or what is commonly called facing and dressing, certain kinds of stone. Patent dated March 18th, 1835; expired March 18th, 1849.

BIRTHS AND DEATHS DURING THE WEEK ENDING THE 24TH INST.

The Registrar-General's report for the week ending Saturday last shows the number of deaths from all causes to be 1,048, being 121 below the weekly average of 1844-5-6-7-8. The return is, therefore, satisfactory. The mortality from epidemics, with the exception of hooping-cough, is little more than the average, and has fallen twenty-five per cent. within the period of a month; scarlatina and typhus were each fatal to forty persons. The fatal cases of cholera were ten, namely:—

St. Pancras; Tottenham.—At 20, Windmill-street, widow of a cabinet-maker, 66, "constipation, dysentery, and cholera (6 days)."

Whitechapel; Goodman's-fields.—The three following cases occurred in the Cholera Hospital, 88, Leman-street:—A labourer, 38, "Asiatic cholera;" wife of the above, 38, "Asiatic cholera;" daughter of the above, two months, "Asiatic cholera."

St. George-in-the-East; St. Paul.—The two following cases occurred in the Cholera Hospital, 3, Bath-terrace:—On the 19th of March, M. 59, removed from the workhouse, "cholera (12 hours);" on the 20th of March, M. 84, removed from the workhouse, "cholera (3 days."

St. George-in-the-East; St. John.—The four following cases occurred in St. George's workhouse:—A widow, 62, "cholera;" a widow, 74, "cholera;" a widow, 34, "cholera;" widow of an umbrella-maker, 62, "cholera."

The number of births during the same week was 1,445.

TO CORRESPONDENTS.

"J. R., Battersea."—The cost would be about £15. A very excellent machine may be procured at any of the makers of philosophical instruments for £18 to £20.

"Mr. J. Wilman, Bristol."—Do not entertain the proposition which has been made to you, but lay a statement of the case before the commissioners. They will most probably consent to mitigate the fine.

"Mr. Millar, Manchester."—We cannot assist you; the subject is not in our province. Apply to Mr. Carpmaël; he may, perhaps, give you the desired information.

"J. T. V."—Use a gargle composed of 7 fluid ounces of decoction of cinchona and 1 fluid ounce of simple oxymel. We must decline giving medical advice to our correspondents.

"Mr. R. Tyler, Manchester."—147, Strand. Messrs. Wm. Orr and Co. are the publishers.

"G. W."—Apply to the publisher of the work (Taylor and Walton, Gower-street).

"R. L. S."—We are not learned in quack medicines, and can give you no information on the subject of your inquiry.

"Mr. Linden, Birkenhead."—The best means of preventing the corrosion of metals is first to dip the articles into very dilute nitric acid, and afterwards to immerse them in linseed oil, allowing the superfluity of oil to drain off. By this means the articles are very effectively preserved from rust or oxidation.

"Mr. Twysden, Brixton."—The cordial which bears Sir Walter Raleigh's name is prepared as follows:—

Take of Fresh tops of rosemary,
Juniper berries, of each 1 pound.
Cardamom seeds,
Zedoary,
Saffron, of each ½ pound.
Proof spirits, 1½ gallon.

Digest for a fortnight, express, and strain; evaporate the strained liquid to 2½ pounds, and add—

Gascoigne's powder, 1 pound.
Cinnamon,
Nutmegs, of each 2 ounces.
Cloves, 1 ounce.
White sugar, 2 pounds.

Mix the whole of the ingredients well together.

"A Student."—We think Fresenius (qualitative and quantitative analysis) will answer your purpose best.

"Mr. Johnston, Glasgow."—We are no great admirers of the use of fulminating gold in medicine. We know that that agent has in several cases produced serious, nay, fatal, results. The readiest way of preparing fulminating gold is by digesting terchloride of gold in ammonia in excess. We would, however, advise our correspondent not to meddle with the preparation of that dangerous compound, or, at all events, to make only a very small quantity at a time. Its explosion may be induced by the slightest friction, or by any sudden increase of heat.

"A. C. W."—We have given in some of the preceding numbers, and give also in the present number, a series of recipes for vitrifiable pigments of a variety of colours. We refer our correspondent to these recipes.

"Ignoramus."—The term "ozone" does not denote a metal or salt, as our correspondent seems to imagine. The term is used to designate the peculiar odour which is perceived in the immediate vicinity of electrical machines in good action.

"Mirror."—We are sorry we cannot assist our correspondent in his researches.

"G. T."—Received.

"A Traveller."—We know no specific against sea-sickness. The horizontal position would appear about the most effectual preventive. A glass of warm weak brandy and water, with one or two drops of creasote in it, has usually a very good effect, particularly if the stomach and bowels are in proper order.

"W. J. B."—We beg to return you our best thanks. Your request has already been complied with.

"Mr. Williams, Chelsea."—The work is out of print. We hardly think you will be able to procure a copy, except perhaps at a bookstall.

"W. C."—Blistering tissue is thin paper or silk, spread over with a thin coat of alcoholic, acetic, or ethereal extract of cantharides.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of Nn. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—March 31, 1849.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 184.]

ON THE NATURE OF MOLASSES, AND THE PROPER METHOD OF TREATING IT, WITH REFERENCE TO THE PRODUCTION OF SUGAR.

Having successively considered the chief methods pursued to effect drainage of the non-crystallized from the crystallized portion of concentrated saccharine juices, and in what respects they are adequate or inadequate to the end desired, it now remains for me to devote some attention to the product of such drainage, which product is denominated by the vague term molasses.

It may be inferred from the previous remark that the investigation of the nature and properties of molasses will best be prosecuted by starting from the assumption that sugar may be concentrated by evaporation, without any destruction whatever.

I have already remarked that this condition it is impossible absolutely to achieve; but by removing from the solution to be evaporated all destructive agents, and by properly regulating the application of heat, the amount of destruction may be reduced to such a minimum that the molasses, or syrup of drainage, shall virtually, though not actually, be an aqueous solution of pure sugar.

Descending from this extreme summit of excellence to the other extreme of the scale, we at length arrive at the results of Soubeiran's experiment, wherein every particle of sugar was destroyed.

Within the limits bounded by these two extremes, the ratio between the amount of sugar destroyed and the amount crystallized may vary indefinitely; each product yielding a liquor, or syrup of drainage, to which the general term molasses will be applied; although such liquor of drainage may be anything from an aqueous solution of sugar, accompanied by some mere traces of foreign bodies, up to a compound of little else than glucose, mixed with its black acid derivatives.

It is evident, therefore, that the term molasses is a most indefinite one; and should never be used in argument until its meaning has been specially limited to the conditions of the instance under discussion. It appears, then, that liquor of drainage, or syrup (molasses), there ever must be, as the result of the crystallization of sugar, even under the most favourable circumstances; and the question of the best mode of treating it, for the purpose of obtaining its sugar, must be determined by reference to its richness in that substance.

And here the sugar-producer is met on the very threshold of his subject by the necessity of accommodating his operation to an ill-defined popular taste. Were it a question with the colonial sugar-producer of selling the pure material, *sugar*, his course might indeed be very difficult, but it would, at least, be well defined At any price, cost what it might, he would be driven to cleanse all his raw crystallized material from every particle of colouring, or other non-crystallized substances; in other words, from every particle of its *molasses*. Such, however, is not the desideratum which the sugar-producer has in view; the public expects him to produce a coloured sugar; that is, a white sugar, each crystal of which is coated with a certain amount of molasses, to which latter the qualities of moistness and colour are due. Now, the question of how much molasses shall be thus allowed to remain, as a coating, involves the consideration of such indeterminate matters as—variety of popular tastes; of manufacturing expenses,—the comparative value of sugar and rum, &c. As a general rule, however, the West India sugar-producers (those of Jamaica excepted, who obtain a high price for their rum), consider it profitable to boil the juice very stiff, and export the muscovado sugar in a very undrained state. The glaring impropriety of this procedure has already been pointed out; therefore I need not advert to it again. It is desirable, however, to find adequate causes for a practice which appears so repugnant to all common intelligence.

The causes are chiefly as follow:—1. The desire of the overseer to make a display of the quantity of sugar shipped. 2. The low market price of molasses by itself, compared with the market price of molasses as forming a part of muscovado sugor. It is painful to have to record the fact that the real owners of a great number of West India estates are not the ostensible ones, but merchants or brokers at home, who, by way of mortgage, have a direct lien on the property; and, indirectly, have the privilege of exclusive management, with all the commercial advantages thereby accruing. Under these circumstances it is too frequently an object with the resident agent to make a display of a large amount of sugar produced on his estate, whereas the amount is merely one of sugar, plus the molasses absorbed. The material, being thus placed on shipboard moist and undrained, may, under the circumstances of a fair wind and easy passage, arrive here without great loss. If it do so arrive, its sale may be accomplished. The English grocer, by dint of mixing it with dry refinery pieces and a certain portion of dry East India or Mauritius sugar, at length forms a compound of remunerative selling price, and all parties are satisfied. If, however, the passage should be rough, causing much agitation to the cargo,—if the temperature should be unusually high, or the hogsheads unusually leaky,—then a large portion of the molasses percolates into the hold, and is pumped overboard.

Thus the present West Indian sugar manufacture is made to assume an appearance of risk and uncertainty; which so far from necessarily belonging to it—at least in the way indicated—may, by a system of improved treatment, be prevented altogether.

It is a question very commonly put by the colonial sugar-producer, whether a specimen of sugar resulting from a certain process will stand the voyage? To such a question there is one general answer. Any sugar will stand the voyage provided it be well drained, and that it be freed from all impurities which are of a deliquescent nature. Sugar itself is unalterable in an atmosphere of very considerable dampness; and the mere adherent brown or yellow coat of molasses, which imparts the peculiar colour and sensation of moisture, without clamminess, to good muscovado sugar, is not sufficient in itself to cause any loss by drainage.

As regards the second reason which influences the West India sugar-producers in allowing their staple to be largely admixed with molasses, viz., the low value of molasses by itself as compared with that of molasses when it forms part of muscovado sugar, it will be evident, on reflection, that the amount of sugar contained in bad molasses may be so small, so much admixed with impurities, that it either may not pay for re-evaporation, or that it must be evaporated alone. To evaporate it in the teache, mingled with fresh or uncrystallized syrup, would be impracticable, on account of the mass of impurities which would be thus imparted. It will be, moreover, evident that, beyond a certain point of richness in sugar and general purity, molasses may thus be treated with propriety. Hence we are brought again to contemplate the first grand source of all improvements in the colonial sugar produce,—the perfect defecation or purification of the juice. Until some process conducive to this end be generally followed by our colonists,—until some means be devised of rendering the molasses or syrup of drainage so pure that it may be returned without prejudice to the teache, and boiled with the concentrating juice—the chemist will expatiate in vain on the theoretical indications of low boiling, and perfect drainage, as necessary to the production of a well-crystallized sugar. So long as the general run of molasses is of its present average impurity, so long will it be impossible to be boiled except alone—a process involving the use of more fuel than the West Indian colonist can command; indeed, if he could, the result would be scarcely marketable; and so long will the weight of semi-solid saccharine produce (sugar is a wrong term) obtained be the result of the first, and only, boil. If, however, the sugar-producer could be made to follow some plan of defecating his juice, that would ensure a molasses so pure that it might be returned to the teache, and the process repeated through several operations, he would then have no plea for the continuance of his present ill-judged plan; which may be, without impropriety, designated an operation of smuggling, devised for the purpose of selling molasses under the name of sugar.

If the West Indian sugar-growers were to be furnished at once with a never-failing means of producing a large-grained, and therefore an easily-cured, sugar, to the exclusion of all other, their produce would have to encounter a difficulty which the consumer would scarcely have imagined. Such large-grained sugars are very unfavourable to the perpetration of certain mysterious operations of legerdemain, which grocers understand too well. They will not mix. A small-grained sugar may readily be incorporated with glucose, with pieces, or bastards, and other less innocent bodies, without such incorporation being discoverable to the eye. A large-grained sugar, on the other hand, is a most refractory material for these little manipulations;* its crystals, no matter how mingled with contaminating agents, never ceasing to manifest their native brilliancy, and thus proclaiming the fraud. It is most easy, then, to understand why the grocer, as a rule, does not encourage these large-grained sugars. He cannot manipulate them, and, therefore, brands them with a fault. He says they are deficient in saccharine matter,—that they will not sweeten. True it is that comparatively small portions of these large-grained sugars are sold,—and sold at high prices; but merely as fancy articles; on the proceeds of which the grocer nets too little to make their sale an object of primary solicitude.

Such is the source of one prejudice against dry and large-grained sugars—a prejudice originating amongst the grocers. There is also another which originates amongst refiners, who are adverse to the general consumption of these beautiful colonial sugars, for the very obvious reason, that the consumption of their own staple is thereby lessened. The refiner's expressed objection is remarkable as embodying a philosophic idea not at all known to chemists, and, in fact, adverse to all chemical analogy. He is in the habit of saying that such large-grained sugars produced in the colonies contain a great amount of water, and that hence they are, what he terms—weak. Now, for the sake of argument, we will assume this to be the fact, and will see how it bears upon the refiner himself. If the vacuum-pan accomplishes the incorporation of water with sugar in the colonies, of course a similar effect results at home *in refineries*. Hence the refinery operation, thus proved to consist in effecting the crystalline incorporation of water with sugar, must be profitable beyond any limits which the public or the Chancellor of the Exchequer has hitherto assumed; and this enormous profit should be at once adequately taxed! To such absurdities are we led by arguing from loosely-expressed current data.†

* Technically called handling.

† Lest it be thought I unjustly impugn the science of practical men well conversant with sugars, I will here mention two circumstances; one for the truth of which I vouch, the other communicated to me by one of our largest metropolitan copper-manufacturers. Towards the end of the summer of 1848 I showed to a London broker a very fine sample of well-crystallized colonial sugar. His comment was most peculiar. He told me that "now-a-days popular taste required the grain of sugar to be of a different shape to mine; people now liked grains with *rounded*

IMPROVED METHODS OF DEFECATING OR PURIFYING SUGAR-CONTAINING JUICES.

Having pointed out the injurious agency of lime as a defecating agent, I will now pass in review the chief methods which have been had recourse to from time to time for accomplishing the important end of defecation without the employment of that destructive, although not very efficient, alkaline earth.

And here I will remark that there scarcely exists a mineral salt of whatever kind that does not, when a solution of it is added to sugar-containing juices at the proper temperature—usually about 180°—cause the precipitation of bulky, flocculent masses, being combinations of the impurities existing in the juice, with the mineral base of the salt. By witnessing effects of this kind persons unacquainted with chemistry have been led to the most unsafe conclusions, and numerous are the pseudo discoveries thus palmed upon the world.

To defecate merely, or effect the separation of impurities from sugar-containing juices, is but one portion of the problem to be solved. The defecating process must be effected without destruction to the sugar, and by an agent that is so perfectly under control that any excess of it above the quantity necessary to effect defecation shall be easily removable. For practical purposes, another and a most important condition must be achieved. The whole must be effected within the limits of a remunerative cost.

It is painful to con over the numerous projects,—specious enough at a first glance, but in violation of the rules of guidance, or indications laid down,—which have been thrust upon the sugar producer and the refiner so often, and with such unvarying failure,—that all new plans, however intrinsically good, are regarded always with suspicion and doubt—often with neglect or contempt.

Thus, in a patent specification lately published, sugar solutions in the colonies, and in refineries, are proposed to be defecated by operations that would effect the liberation in the sugar of nitric, sulphuric, prussic, and oxalic acids, without any provision for removing either of these deadly substances! Fortunately there is a chemical safeguard here. The presence of a minute trace of oxalic acid prevents the crystallization of sugar,—and the same remark applies, though less forcibly, to the presence of nitric and sulphuric acids. The author of this patent, being totally ignorant of chemistry, was misled by the fallacious appearance of a mere separation of coagula.

Foremost amongst the materials which have been employed at various times, both in the colonies and for refinery use, is the earth alumina, in some of the various states which it may be made to assume. The idea of employing alumina seems to be derived from a somewhat analogous application of this substance for the making of vegetable colouring matters termed lakes. Thus, if a decoction of logwood be mixed with a solution of the salt alum,—which is a compound of sulphuric acid, potash, and alumina,—and a solution of potash added, the earth, alumina, is set free, and, immediately combining with the colouring matter of the logwood, both fall in union, and constitute a precipitate that when dried and powdered is called a lake. Instead of logwood, various other vegetable and some animal colouring bodies may be substituted, and with a similar result.

Following out this idea, alumina has been employed, with the view of separating the colouring matters out of solutions of muscovado sugar, and the general vegetable impurities out of cane-juice.

On cane-juice I have never had an opportunity of trying it; but on solutions of muscovado sugar I have frequently tested the powers of alumina, without in any case being much struck with its utility. A certain defecating effect it unquestionably produces, but by no means to the extent that would induce one to anticipate any vital or radical improvement in the sugar manufacture, home or colonial, by generally adopting it. Not long since I was called upon to witness the effect produced by a mixture of alumina, sulphate of lime, and bone-black on a solution of Khaur sugar.* The experiment was shown me as a triumph, but I was at a loss to conceive how the result could have been worse.

Alumina, as prepared in its purity by chemists, would be inapplicable to the purpose indicated, no matter how successful in its results, merely from considerations of expense: many cheap modifications of the material have, therefore, been from time to time devised. One of the most general of these was discovered by the Honourable Mr. Howard (the inventor of the vacuum-pan), in 1812; and consists of a mixture of sulphate of lime, free lime, and alumina. This mixture, commonly known as Howard's finings, is prepared by adding to a solution of alum, in water, a sufficient portion of cream of lime, to combine with all the sulphuric acid of the alumina; to throw down the alumina; and to leave an excess of lime. The supernatant liquor of this operation, consisting of sulphate of potash, must be absolutely washed away, or it will impart an injurious quality of deliquescence to such sugar as may be prepared with the finings. In a patent of some years' standing, chalk instead of lime is used to decompose the alum; with what advantage, however, is not so obvious.

In France and other countries where sugar is largely manufactured from beet-root juice, the sulphate of alumina (not alum, which is the potash sulphate of that base) is largely employed as a defecating agent. On solutions of muscovado sugar I can affirm from experience that its defecating properties by no means come up to the expectations I had been induced to form.

Very far superior to all other agents as precipitants for the vegetable impurities of natural sugar-contaiuing juices, as also for the impurities existing in muscovado sugar, are the acetates, particularly the basic or sub acetates of lead.

So wide is the sphere of operation which these bodies possess, as precipitants of the albuminous and coloured matter of vegetable juices, that even the juice of beet-root, which after being allowed to remain in contact with the air for about half an hour becomes black, is instantly purified to such an extent that when filtered it resembles water. Not only do these salts of lead precipitate the general impurities from raw vegetable juices, but even a number of dark-coloured decoctions are rendered, by treatment with it, comparatively colourless in a few instants. Chemists have long been aware of this property, have long used the acetates of lead as precipitating agents for certain albuminous and coloured matters in the laboratory, with the most perfect success; every attempt, however, to employ these agents satisfactorily, even on the small scale, for the purpose of throwing down the impurities from muscovado sugar in solution, or from cane-juice, was unsatisfactory; whilst on the large scale the attempt, when tried, failed altogether.

The reasons of this failure, in the employment of lead salts, for the purpose indicated, are various; as will presently be recognised.

The first problems to be solved are these: either to use the lead salt in such exact proportion to the amount of impurity with which it is intended to combine, that both shall fall down in combination, and be capable of removal; or to add a known excess of lead salt to the sugar solution, to separate the precipitate caused by filtration, then to throw down from the filtered liquor all the remaining lead by means of some precipitating agent not productive of injury to sugar; and, as a subsidiary problem, to remove the acetic acid liberated from the lead, either as an insoluble compound, or to combine it with some body that shall neither be injurious to sugar, nor to health, and separable, if possible, by the process of drainage.

Such are the necessities of the case,—even in the laboratory, on a small scale. Let us examine how they can be met.

The first problem does not admit of solution; it involves an impossibility, inasmuch as, however small, above a certain microscopic limit, the quantity of lead salt added, the filtered solution will still contain lead, although a fresh addition of more lead salt to the latter will not fail to produce a new precipitate. This circumstance can be accounted for by assuming the concurrent formation of two or more compounds of lead and vegetable matters, one compound being soluble and the other not.

In operating on sugar thus we are reduced to the necessity of disregarding as a means of safety all apportionment whatever, but of throwing down all excess of lead.

Simple as this may appear as a laboratory operation, it cannot be accomplished by the ordinary laboratory means. The usual agent employed by chemists to separate lead out of solutions is hydrosulphuric acid gas,—a body which throws it down effectually from sugar solutions, it is true, but spoils the sugar; in consequence of the facility with which, by trifling circumstances, it is decomposed, with the liberation of sulphur. Hence, so frequently had the experiment been tried, and with such uniformly bad success, that not only was the idea of employing these agents in combination relinquished, but the ruin of the sugar was attributed, not to the proper cause,—the effect of hydrosulphuric acid employed to separate the lead,—but to the lead itself.

The employment of hydrosulphuric acid thus being out of the question, we have next to examine the other means commonly employed in the laboratory for accomplishing that end. Occasionly sulphuric* acid is used to separate lead out of solutions, which end it accomplishes perfectly, even out of those sugar; but if sulphuric acid be employed it is incumbent on the operator to add one exact quantity, no more, no less; if too much, the free or uncombined overplus of acid, by acting on the sugar, would speedily convert it—first, into glucose, and thence downward in the scale of destruction into glucic, melasinic, sacchulmic, sacchumic acids, &c.; if too little, there would remain an excess of lead, which not only is injurious to health, but, if boiled with sugar, it also is a very destructive agent.

The question of lead then, as a defecator for sugar, seemed hopeless. Its remarkable action was witnessed, admired, and abandoned; until, in the year 1839, Messrs Gwynne and Young took out a patent for the separation of the excess of lead by means of the diphosphate of lime, an agent which, in the laboratory, can be made to succeed perfectly; but which I believe to be, both on the score of expense and uncertainty, totally inapplicable on the large scale.

These gentlemen, however, deserve great praise for their investigations, which are, chemically considered, of a masterly kind. Although the operation necessarily failed in practice, for reasons which I have indicated, its perfect success in laboratory quantities, demonstrated the most important fact, that the acetates of lead, *per se*, were not injurious to the constitution of sugar.

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angles!" The copperworker's anecdote is as follows:—"I was once sent for in a great hurry," he very naïvely told me, "to a refinery where a vacuum-pan of mine had been some time in work. I lost no time in hastening there, for the message was urgent. 'I want you to get a hole bored in the dome of that pan,' was the sage request of the refiner on my arrival. 'A hole in what?' said I. 'In the dome of that pan,' answered the refiner. 'But for what?' 'Because it is too tight—there is too much vacuum—in short, the pan won't do.' In vain I remonstrated—in vain I pointed out the absurdity. The refiner had only one answer, 'His boiler said the pan was too tight, and bored a hole must be forthwith.' It was accordingly done." In fairness to the refiner it should be remarked that his vacuum-pan had formerly a leak in it, which leak having been stopped, the boiler *fancied* that the pan worked less satisfactorily than before. From these premises a very absurd conclusion was arrived at, as we have seen.

* A most impure result of the native sugar manufacture in Hindostan.

* Sulphuric acid has lately been tried by a gentleman in India, who utterly failed, however, in achieving the object proposed.

This demonstration having been accomplished, the chemist was warranted in resuming the task of finding out some precipitating body that should not only act in the laboratory under chemical superintendence but one that should act anywhere and in any quantity.

Such an agent I was fortunate enough to discover in July, 1847. This precipitant is sulphurous acid gas, the methods of employing which I have recorded in another publication, and, therefore, need not repeat here; seeing that my present object is simply to record a chemical fact.

Since the period of July, 1847, the efficacy of this gas has been tried on the large scale in a refinery, and also on cane-juice;—in both cases with the utmost perfect success.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

HINTS TOWARDS A CLASSIFICATION OF COLOURS.

By Professor J. D. FORBES.

[*Concluded from page* 292.]

The law of composition of the secondary and tertiary colours is, however, worthy of notice, and may be represented in the following diagram:—

Red $=r_8$	Orange $=r_4y_4$		
Yellow $=y_8$	Green $=y_4b_4$	Citrine $=y_4b_2r_2$	Green hue $y_3b_3r_2$
Blue $=b_8$	Purple $=b_4r_4$	Olive $=b_4r_2y_2$	Purple hue $b_3r_3y_2$
Red $=r_8$	Orange $=r_4y_4$.	Russet $=r_4y_2b_2$	Orange hue $r_3y_3b_2$
Yellow $=y_8$		Citrine $=y_4b_2r_2$	

Hence citrine, for instance, is a mixture of four parts of yellow with two of blue and two of red, which is equivalent to two parts of yellow and six of neutral grey (since grey $= ybr$); citrine is, therefore, yellow verging into grey, one fourth of the mixture being yellow and three fourths grey.

Let us take an instance of a still more indefinite colour, a colour of the fourth order, which Mr. Hay calls a secondary hue, and to which he gives the distinguishing names of orange hue, green hue, and purple hue. We find these to be thus composed:—

$$r_3y_3b_2,\ y_3b_3r_2,\ b_3r_3y_2;$$

or thus:—

2 orange + 6 grey, 2 green + 6 grey, 2 purple + 6 grey.

We, therefore, refer them at once to their places in Mayer's triangle as intermediate between the secondaries and neutrality, and dividing the interspace in the ratio of 3 to 1, as in the former case, only here the compound is more neutral, because the secondary colours are themselves one stage on the way to neutrality.

Thus we arrive at this conclusion, that all combinations of three primary colours (as far as difference of quality is concerned) may be represented by transitions from the primary and secondary colours into grey; and thence, though it may appear at first sight paradoxical, though the quality of a primary or secondary colour (such as red or green) is not changed by diluting it with white, it is changed by mixing it with grey, or by first mixing it with white and then diminishing the intensity of light in the mixture.

Hence a classification of colours may be made, which, although redundant in some parts, has the advantage of pointing out clearly the composition of each in this point, and also of suggesting a convenient nomenclature, which I propose to adopt in preference to Mr. Hay's (where they differ), as more expressive of the composition of each. This diagram, like Mayer's triangle, includes colours varying in quality, but of standard intensity and of the highest attainable purity. This diagram was obligingly arranged for me by Mr. Hay out of the coloured specimens in his work.

The places marked by asterisks will supply a sufficient number of intermediate hues, as these evidently approach the absolute uniformity of neutral grey in the last column, whilst the first contains the graduated colours of the spectrum.

All these colours may be varied by mixing them with white or black, forming what Mr. Hay judiciously calls tints or shades of any colour.

It is sometimes convenient to have these tints and shades arranged in immediate opposition for the purpose of comparison. This may be conveniently done for the principal colours by having two diagrams. In one, the colours of the spectrum form a circular ring, the colours passing through tints into perfect white at the centre, and the shades continued in outward radiating lines till they coalesce in a perfectly black circumference. In the other the principal intermediates between the principal colours and grey may be exhibited with like transitions. These intermediates may conveniently be denominated by the following terms, sufficiently expressive and in common use:—

Russet intermediate between red and grey.
Brown " " orange "
Citrine " " yellow "
Drab " " green "
Olive " " blue "
Slate " " purple "

Red.	Greyish-red.	Grey-red.	Red-grey. [Russet.]	Reddish-grey.	Grey.
Orangish-red.	*	*			
Red-orange.	*	*	*		
Reddish-orange.	*	*			
Orange.	Greyish-orange.	Grey-orange.	Orange-grey. [Brown.]	Orangish-grey.	Gery.
Yellowish-orange.	*	*			
Yellow-orange.	*	*	*		
Orangish-yellow.	*	*			
Yellow.	Greyish-yellow.	Grey-yellow.	Yellow-grey. [Citrine.]	Yellowish-grey.	Grey.
Greenish-yellow.	*	*			
Yellow-green.	*	*	*		
Yellowish-green.	*	*			
Green.	Greyish-green.	Grey-green.	Green-grey. [Drab.]	Greenish-grey.	Grey.
Bluish-green.	*	*			
Blue-green.	*	*	*		
Greenish-blue.	*	*			
Blue.	Greyish-blue.	Grey-blue.	Blue-grey. [Olive.]	Bluish-grey.	Grey.
Purplish-blue.	*	*			
Blue-purple.	*	*	*		
Bluish-purple.	*	*			
Purple.	Greyish-purple.	Grey-purple.	Purple-grey. [Slate.]	Purplish-grey.	Grey.
Reddish-purple.	*	*			
Red-purple.	*	*	*		
Purplish-red.	*	*			

Mr. Hay has been kind enough to arrange for me his extensive suite of artificial colours according to these diagrams.

But it must be owned to be highly desirable to possess such a suite of colours in more perfect and durable materials than any pigment as usually applied presents. Painted porcelain and coloured enamels alone appear to possess this valuable property. The immense collection of artificial enamels employed in the Vatican fabric of mosaic pictures seems to offer an unrivalled opportunity of forming such a classification.

This gigantic establishment was founded about two centuries ago, for the express purpose of adorning the interior of St. Peter's with the elaborate mosaic pictures and ceilings which astonish every visitor. The whole interior of the stupendous dome is incrusted with mosaic patterns and pictures, of coarse execution indeed, but such as suits best the vast distance from which alone they can be properly viewed; whilst the finished mosaic works which adorn the altars reproduce in unfading colours and with consummate skill in shading the chefs-d'œuvre of Raphael, Domenichino, and other artists preserved in the Vatican gallery. The material is a soft and fusible enamel, and the formation of 18,000 tints was effected by an ingenious artist named Matteoli, at the time I have mentioned. The rough cakes of enamel are preserved in separate cupboards or pigeon-holes, surrounding a hall of great length, appropriated to this pur-

pose by Pope Pius VI. But the main intention of the work being completed with St. Peter's, it has not been thought worth while to preserve the integrity of the collection (which, indeed, would be no easy matter); and it is certain that, though still reputed to contain 18,000 modified colours, the effective number is vastly smaller.

Having been fortunate enough in 1844 to make the valuable acquaintance of Monsignore de' Medici Spada, an enlightened and influential prelate residing at Rome, I entreated his influence to procure a selection of specimens of the leading colours of the Vatican mosaics. For a long time official sluggishness rendered the application fruitless; at length the importunity of my friend overcame all difficulties, but not until I had long left Rome, and was, therefore, quite unable to superintend the selection. My instructions were, therefore, general, to prefer the most varied tints which the collection presented. At last an assortment of no less than 941 pieces of mosaic, classified in separate packets, arrived. A close examination rather disappointed me. They presented a great preponderance of indefinite colours, and a great deficiency of many of the livelier and brighter primary and secondary colors. But particularly whole packets were composed of specimens scarcely sensibly differing from each other. This last circumstance was probably occasioned by the carelessness and indolence of the workmen who selected them. The former circumstances might naturally be expected in a collection constructed for the purpose of imitating paintings, in which, as is well known, optically pure colours are almost never used; but their effect is invariably produced by skilful contrasts. Many of the suites of indefinite colours are exquisitely beautiful. With Mr. Hay's assistance I selected a sufficient number of distinct hues to represent tolerably Mayer's triangle of colours; but, the great mass of colours being only detached suites, it was impossible to combine them into a connected whole. As I have no doubt, however, that the collection is one which faithfully represents the colours chiefly used by artists, it may not be uninteresting to copy the catalogue forwarded to me by Monsignore Spada, with the local names and the principal denominations on the scale of nomenclature proposed in this paper, which they include:—

		Local Names.	Technical Names.
100	specimens.	Bigi.	Tints of yellow-grey, and tints of grey.
100	..	Carnagioni.	Tints of orange-grey [brown], reddish-yellow grey, reddish-purple grey, purple-grey.
60	..	Gialli.	Tints of yellow-grey and reddish-yellow grey.
20	..	Giugiolini.	Orange passing into red and yellow.
60	..	Lacche.	Greyish-red, reddish-grey, yellowish-grey, purplish-grey, shades of purplish-grey.
60	..	Leonati.	Yellow-grey passing into purple-grey, shades of purple-grey.
60	..	Pavonazzi.	Grey-purple and tints of ditto.
76	..	Porporini.	Red and greyish-red.
172	..	Scorzetti.	Tints of yellow, tints of orange, tints of yellow-grey and of red-grey.
91	..	Turchini.	Tints of blue, tints of purplish-blue, greyish-greenish blue.
142	..	Veroli.	Tints of green-grey, tints of blue-green.
941	Total of specimens received.		

This number of specimens would have been sufficient to make a complete series of colours; but, as has been said, they were very deficient in the more positive hues. I have still hopes, however, of being able to obtain a series of perfect matches for the whole series of Mr. Hay's pigments, specimens of which have indeed been already sent to Rome for the purpose.

ON THE VOLATILITY OF CERTAIN FIXED SALTS IN A STATE OF SOLUTION UNDER THE INFLUENCE OF THE VAPOUR OF THE MENSTRUUM IN WHICH THEY ARE DISSOLVED,

AND ON SOME OF THE PURPOSES TO WHICH THIS PROPERTY MAY BE APPLIED.

Report by MM. FOY, BUSSY, and HURAUT, on a Memoir

By M. LAROCQUE.

The property which certain essentially-fixed substances possess to volatilize under the influence of the vapour of the menstruum in which they happen to be dissolved is certainly one of the most remarkable phenomena that chemistry presents.

The vapours escaping from the lagoons or muddy swamps of Tuscany, the waters of which hold a certain amount of boracic acid in solution, carry off a considerable quantity of the latter in the gaseous state, though this acid is decidedly one of the most fixed bodies known to us. This fact, which from its singularity might have been expected to attract the attention of chemists, was permitted to pass altogether unnoticed till 1825, when M. Vogel made a series of experiments on the subject, which led to the establishment of the fact that boracic acid in alcoholic solution volatilizes in the vapours of the menstruum. In the year 1830 M. Saladin, chemist at Orleans, published a very interesting paper on the same subject. This chemist had extended his researches to arsenious acid, bichloride of mercury, hydrochlorate, arseniate, and oxalate of ammonia; sulphur, lime, morphia, brucia, and veratria. He found that all these substances will volatilize under the influence of aqueous, alcoholic, and ethereal vapours.

A paper read in the year 1846, before the Society of Medicine, of Nancy, by M. Simonin, gave a long list of fixed bodies, both organic and inorganic, possessed of the property of volatilizing under the influence of aqueous vapours.

M. Larocque's memoir not only confirms most of the facts previously stated, but greatly adds to the number of fixed substances that are volatile in the vapours of the liquids holding them in solution. The property of volatilizing under the influence of the vapours of liquids would, indeed, appear to be universally inherent in fixed bodies; at all events, nearly the whole of the substances on which M. Larocque had occasion to experiment were found to possess this property. M. Larocque operated invariably on large masses, and conducted the evaporation of the menstruum in the open air, and in vessels presenting a considerable extent of surface.

The first substances operated upon by M. Larocque were potass and soda. These two alkalis, which on account of their non-volatility have been called the fixed alkalis, volatilize under the influence of aqueous vapours in sufficient quantity to cause a violent itching on the parts of the skin which are exposed to the air; and, moreover, a marked irritation of the throat from the inhalation of the vapour escaping from the evaporating copper.

After potass and soda, M. Larocque operated on phosphate of soda, and on the arseniates and nitrates of potass and soda; the results were similar to the preceding. M. Larocque observes that this new property which these three kinds of salts are found to possess in common, viz., to valatilize under the influence of aqueous vapours, renders still more striking the close analogy which is already known to exist between them.

Next on the list come the sulphates of zinc, of mercury, of copper, and of iron, the nitrates of mercury and of silver, the cyanide of potassium, the red and yellow ferruginous cyanides, the neutral tartrate of potass, and the double tartrate of potass and soda. The volatility of one of these salts (sulphate of iron) explains the formation of the ochreous incrustation of subsulphate of iron, which is observed on the walls of the manufactories in which sulphate of iron is prepared on a large scale.

The metallic chlorides also possess the property of volatilizing under the influence of aqueous vapours. These salts present, however, in this respect, considerable differences of degree: thus the more volatile of them, such as the chloride of arsenic, tin, antimony, bismuth, iron, and zinc, volatilize to a considerable extent; whereas the fixed and only slightly volatile, such as the chlorides of nickel, copper, lead, cobalt, and sodium, lose only a comparatively trifling proportion during the evaporation of their solutions.

The same applies to the iodides; it must be borne in mind, however, that these latter salts are liable to suffer decomposition by the action of the heat, with liberation of the iodine.

The ammaniacal salts volatilize equally under the influence of aqueous vapours; some of them, such as the hydrochlorate and the carbonate, volatilize at a temperature below the boiling point of water.

Similar results were obtained with several acetates, butyrates, valerianates, and formates.

This property of certain essentially-fixed substances to volatilize under the influence of the vapour of the menstruum in which they happen to be dissolved has been turned to several practical and useful purposes. M. Larocque, for instance, has endeavoured to render it available in the manufacture of paper-hangings—with what success, time will show.

(M. Larocque's memoir was accompanied by several specimens of papers and designs, prepared by the following simple process*):—

Sheets of white paper are spread on tables or over extended cords placed in a room, having a furnace in the centre. On this furnace is placed a porcelain capsule, containing a mixture of two pounds of nitric acid, sp. gr. 1.38, and one pound of water. One pound of silver is now added to the mixture, and a gentle heat applied to the capsule. The action which hereupon immediately ensues is attended with brisk disengagement of binoxide of nitrogen. Whilst the disengagement of the nitrous vapour continues, a part of the nitrate of silver volatilizes, and produces upon the papers the desired design. According to the shade which it is wished to obtain, the papers are left exposed to the vapour for twenty or forty minutes, when they are withdrawn and replaced by others. When complete solution of the silver has been effected, and the reaction has altogether ceased, the solution is evaporated to crystallization. The nitrate of silver obtained is used in commerce in large quantities; the staining of the papers is accordingly here effected without expense.

According to the length of time the paper has been exposed to the fumes, and also according to the greater or less distance it was placed from the capsule, a plain coloured or a dotted paper will be obtained; the latter greatly resembles granite in appearance. If white designs are required, such as leaves, laces, &c., it is only necessary to cut out the wished-for designs, and to arrange the cut slips properly on the paper sheets previous to exposing the latter to the action of the fumes.

The papers thus prepared are very strong, and do not suffer any alteration by exposure to light and air, which may be readily conceived, considering that silver is the colouring principle.

Now, in what state does the silver exist on the surface of these papers? Is it in the metallic state, in the state of oxide, or in combination with organic matter? M. Larocque has made several experiments with a view to solve this question; the result of these experiments, however, have not enabled him to come to a positive

* Besides nitrate of silver, other salts were tried with similar, though inferior, results.

decision on the point. Nevertheless, the fact that papers stained by the process which we have just now described are speedily decolorated by simple contact with a solution of hyposulphite of soda, iodide, bromide, or cyanide of potassium, tells strongly in favour of the last of the three suppositions, viz., that the staining material consists of a compound of silver with some organic matter.

The cyanide of potassium more particularly has the property to remove with the greatest facility the stains produced by nitrate of silver on organic tissues, no matter what the age of the stains may happen to be.

The benefit to be derived from M. Larocque's investigations will not be confined to manufactures alone. The analytical chemist, the toxicologist, the pharmacien, and, possibly, also the physician, may derive some useful information and hints from them.

Thus, the chemist should take care, when evaporating saline solutions, to apply a very moderate heat only, especially if he happens to be engaged in quantitative investigations: neglect of this precautionary rule might lead to the loss of a portion of the products, and thus vitiate the results of the analysis. The same remark applies to toxicological processes, where inattention to this rule might be attended with serious results.

The chemist should also carefully avoid the use of alcohol or ether that has been employed before for the preparation of extracts; or vegeto-alkalis, or other active principles, unless, indeed, it be for the manufacture of the same or analogous preparations.

The physician, finally, may take advantage of this property for the purpose of administering in the form of vapour (from aqueous or alcoholic solution) certain medicinal agents which it has hitherto been deemed impracticable to apply in the gaseous form.—*Journal de Pharmacie.*

PHARMACY IN SPAIN.

Report on MM. Chiarlone and Mallaïna's History of Pharmacy in Spain

By MM. CAP AND GAULTIER DE CLAUBRY.

The authors divide their history into four epochs: the first extending from 640 before Christ to the third century of our era; the second, from the ninth to the sixteenth century; the third, from the sixteenth to the nineteenth century. The fourth epoch comprises the nineteenth century.

We will not dwell on the first epoch. The facts of that period relate to the general history of the sciences, and those appertaining to chemistry have been learnedly unravelled by M. Höefer. The portion of these details relating to our profession has been compiled by one of us (M. Cap) in the "History of Pharmacy" now in course of publication, and of which the two first parts are principally devoted to the history of the pharmacy of the ancients.

The second period will appear the more interesting, inasmuch as it enlightens us as to the history of our art as practised by the Arabs.

A Jewish university established at Sara, in Asia, in the ninth century, produced some remarkable men.

In the Arabian schools of Cordova, Seville, Murcia, Saragossa, Toledo, &c. &c., the works of numerous authors are found, which are deserving of note. It is known that Abenzoar, who lived in the twelfth century, made the manufacture of syrups and electuaries his particular study—the preparation of medicines, the properties of medicinal plants, and the method of mixing them. In the fourteenth century a work entitled "Liber Secretorum" was written by Bubacar, in which he speaks of the salt of urine, and of a species of moon obtained in distilling urine with white clay, chalk, and carbonated organic matters, a process which greatly resembles that employed by Brandt in the 18th century to obtain phosphorus, and which might have been already known by Bubacar.

Under the government of Alonzo the Judge, in 1252, divers laws were passed relative to the practice of medicine and pharmacy; inspections were made twice a year, from the commencement of the fourteenth century. The *fueros* of the provinces necessarily caused differences in the legal enactments, but, nevertheless, a general system of organization was manifested at this period. In 1403, under the reign of D. Martin, severe laws were established relative to the sale of active preparations, and punishments were inflicted when accidents occurred from their use.

Lopez de Villalobas wrote, in 1488, when but nineteen years of age, a treatise in verse, entitled "A Summary of Medicine," in which he devotes numerous stanzas to purgatives, theriaca, ointments, and plasters. Towards the end of the fifteenth century Julius Gutieris de Tolèdo wrote some interesting observations on syrups and juleps.

The first Pharmacopœia published by a chemist was in 1497, by Pierre Benedicto Matheo, who, as is seen, wrote one hundred and fifty-nine years before Michel du Scean; but the latter is considered by many authors, and in particular by MM. Henry and Guibourt, as being the first chemist who had written on this art. In 1486 Saladin d'Ascala wrote his "Compendium Aromatorum," in which he describes the conditions necessary for the preservation of medicines. He mentions the following fact, proving that the adulteration of medicines has not been confined to our times. A chemist was fined nine thousand ducats, and deprived of his civil rights during twelve months, for having adulterated manna with sugar and starch.

Pharmacy in Spain made in the sixteenth century great advances, which the discovery of the New World must have singularly accelerated. In 1535 the College of Apothecaries of Barcelona published the "Concordia Farmacopolarum Harchinonensium," and that of Saragossa, in 1553, the "Concordia Aromatorum" and the "Farmacopea Cesar-Augustana," which were complete treatises of pharmacy, embracing all relating to that science. A special and very lengthy code of laws relating to pharmacy was enacted, which deserve notice on account of the remarkable regulations they contained.

We regret not being able to analyze that portion of Drs. Chiarlone and Mallaïna's work relative to the state of pharmacy in Spain during the third epoch; we should have found therein curious and important details, a great part of which are quite unknown in other parts of Europe. Until the present time, little attention has been paid to the scientific literature of a people who, in many other respects, have furnished documents of a useful nature, so that the union of many special conditions were necessary in order to investigate all that that country had produced relative to pharmacy. The authors of the work we are analyzing were in the most favourable position for this purpose, and have gladly profited by it.

The seventeenth century again offers much that is important in the history of Spanish pharmacy, both as regards the publication of numerous works by chemists, and the legislation on this subject. Although much in advance of France in this respect, Spain was but very imperfectly known. The splendour of her conquests in the New World, and the importance of her wealth, attracted universal attention; and even those whose particular studies might be expected to have led them to a knowledge of the laws relative to our profession partook of the general opinion as to the state of ignorance in the Peninsula.

We see in the eighteenth century a continuation of that movement previously given to pharmaceutical science, and improved legislation in reference thereto, indicating here, as elsewhere, the disposition of the directing minds of that period. The number of books published, and the nature of the subjects to which they relate, are necessarily affected by the intellectual movement of this century, and in this respect Spain was not behind other nations. France has been accused—and it must be confessed not without cause—of not occupying herself sufficiently with the occurrences of other countries. German literature, and even that of England, are more *au courant* of what is publishing elsewhere than is the case in France.

A very interesting chapter of the work to which we are alluding terminates the history of the third epoch. It treats of the pharmaceutical colleges of Spain. We cannot refrain from giving some of the details. These establishments, anterior to all the scientific academies of Europe, existed at Valencia, Barcelona, Saragossa, Pampeluna, Madrid, Seville, Toledo, Tarragona, and in some other towns.

The college of Valencia already existed in 1327, in the reign of King D. Alphonse, who granted to the apothecaries of this city the rights of admitting into their body all those wishing to exercise this profession. In 1441 the apothecaries petitioned the Queen, Donna Maria of Aragon, to be allowed to constitute the college into an associatisn for their mutual protection, and the exercise of charity to each other.

The privilege granted them orders that all apothecaries are to use uniform weights; it prohibits the sale, by those who have not been received by the college, of all distilled waters, excepting those of orange-flowers, rose, &c., and contains minute details as to the conditions of admission and other rules which we cannot enter upon.

In 1512, at a general meeting of apothecaries, it was enacted that no one could be received until he had practised for eight years, instead of six, which was the former law; and rules were established relative to the theoretical and practical examinations the candidates were to undergo. In 1601 the college published the "Farmacopea Valentina," of which there was a new edition in 1629. The College of Barcelona existed in 1352, and published a Pharmacopœia in 1535.

The fourth epoch of pharmacy, which includes the present century, contains less unknown details than those preceding, but nevertheless deserves notice, especially in relation to pharmaceutical legislation, which was rendered much more perfect.

Carbonell's work, translated into French, was at this period an interesting event in the history of pharmacy; but many other works of some interest appeared at the same time.

Although the details relating to the history of pharmaceutical literature, with reference to the period anterior to our century, are full of interest, yet those which relate to the present century leave much to be desired.

We will content ourselves with referring to two instances illustrative of this: the works of Pelletier are noticed in so incomplete a manner that it would be difficult to form any idea of them; the names of Serrullas and Robiquet are not even found amidst those who have advanced French pharmacy in our time. We must frankly say that this portion of the work is not nearly equal to the previous parts.

If the pharmaceutical legislation of our country has excited such numerous and legitimate reclamations, and if we are desirous of seeing it cast off that which it has inherited from past centuries, it is curious to see that Spain, which we imagine to be so much behind us, has preceded us in this respect in a remarkable manner.

At a time when the titles of nobility were a distinction to which all classes could not aspire, we are interested and surprised to find a privilege granted in 1650 by Don Philippe, placing in the same rank with physicians all those practising pharmacy, and declaring that they could not be admitted to the practice of any mechanical art, then looked upon as beneath that of medicine and the liberal arts.

In 1800 Don Carlos declared pharmacy to be distinct from medicine, and formed laws relative to the examinations and inspections of phar-

macies. To be enabled to practise the degree of bachelor and doctor of medicine was necessary in addition to that of licentiate of pharmacy; the inspections were made by a physician and a chemist, and presided over by one of the elder professors of medicine or pharmacy. A higher assembly was established for the faculty of pharmacy, and charged with all the details of administration for the whole kingdom.

In 1804 the same sovereign made several modifications to the previous laws. He established a botanical garden and a museum of natural history in each college. The pupils had to attend for three years the practical and theoretical lectures of the colleges.

In order to pass from one course to another the pupils had to undergo a severe examination on each subject of their instruction. To obtain the degree of bachelor they were required to lecture in Latin for half an hour on one of the branches of pharmaceutical science.

The grade of licentiate was to be obtained after two years' practical exercise in the laboratories of the faculty, or in a chemist's shop; a theoretical examination, and one on practice, on two different days, were obligatory. After these examinations the candidate was required to recognise and define a certain number of plants and medicines, and answer queries relative to the doses in which very powerful medicines are administered. The licentiate might practise pharmacy throughout the kingdom. To obtain the degree of doctor the candidate was required to treat on any subject chosen by the college, and to answer all arguments presented to him. Some laws relating to military pharmacy completed the code.

In 1815 Ferdinand VII. remodelled the higher assembly, and extended pharmaceutical instruction, which from that time has consisted of a course of natural history, of physics, of chemistry, practical pharmacy, and of theoretical pharmacy.—*Journal de Pharmacie* and *Pharmaceutical Journal.*

ON THE EXTRACTION OF MANNITE FROM THE ROOT OF DANDELION (LEONTODON TARAXACUM).

By Messrs. T. and H. SMITH.

*With an Analysis of the Dandelion Mannite, by Dr. Stenhouse.**

I bring the following communication before the society at the request of the Messrs. Smith, of this place, well known as the authors of several important researches in pharmaceutical chemistry.

They have recently had occasion to prepare on the large scale the preparations of dandelion-root, and were led to observe that among the substances separable from the infusion of the root was the unfermentable so-called sugar, mannite, which has not hitherto been generally included among the chemical constituents of the dandelion.

For the sake of those members of the society who do not devote themselves to chemistry I may here notice that mannite is a crystallizable white substance, originally known as derived from the drug manna, an exudation from several trees of the species Fraxinus and Ornus. It is inodorous, bland, and sweet, but is distinguished from the true sugars by two characters; the one, that it is not susceptible of the vinous fermentation; the other, that it cannot be represented in its chemical formula as a simple hydrate of carbon (C + H O), its composition being $C_6 H_7 O_6$, or $C_6 + 6HO + H$.

It was obtained by Messrs. Smith from the dandelion by the following process:—The clear liquid obtained by the action of cold water on ninety pounds of the root was concentrated in a vacuum-still to the consistence of a syrup. It was then at the temperature of about 150° F., below which it solidified into a thick jelly, incorporated with about four gallons of rectified spirit of wine. An abundant precipitate speedily formed, consisting of albumen, pectine, and other substances, and the liquid on standing became nearly clear. Gradually, however, as the liquid cooled, beautiful arborescent clusters of crystals began to form. They slowly increased in number and size, till they eventually occupied with their spongy mass the entire capacity of the containing vessel. They were soon recognised to be mannite. The spongy mass was transferred to a cloth filter, and subjected to strong pressure, so as to separate from the crystals the bitter liquid which occupied their interstices. They were then digested in fresh alcohol, compressed anew, and the processes described repeated till the crystals had a pure sweet taste. The finely-crystallized specimens were obtained by boiling alcohol on the purified mass, and passing it through a filter in a hot-water funnel. In a few minutes the filtrate solidified into a spongy crystalline mass.

The Messrs. Smith believed themselves to be the discoverers of mannite as an ingredient of taraxacum, a conclusion to which they were naturally conducted by the circumstance that none even of our recent English works on materia medica, or organic chemistry, with the exception, so far as I am aware, of Dr. Christison's "Dispensatory," recent edition, mentions mannite as derivable from the dandelion, and he simply says that "it contains mannite." In ignorance, accordingly, of any earlier researches having been made on the subject, the Messrs. Smith have investigated the subject for themselves, and have made some interesting observations to be presently detailed. They inferred that the substance which they had found was mannite, from its physical characters, which are exceedingly well marked, and, as it should seem, sufficient for its recognition. They thought it, however, desirable to have the certainty of the body they had extracted from dandelion-juice being mannite put beyond doubt by its ultimate analysis, and at their request I submitted the substance to Dr. Stenhouse, of Glasgow, who is more familiar than probably any other of our chemists with the chemical relations of mannite, on which, as occuring in various *alagæ*, he has published some interesting investigations. The following are the results obtained by Dr. Stenhouse, in the analysis he was good enough to make. The accepted formula for mannite is $C_6 H_7 O_6$, so that it should contain:—

Carbon	39.56
Hydrogen	7.69
Oxygen	52.75
	100.00

The dandelion mannite contained in 100 parts:—

Carbon	39.58
Hydrogen	7.84
Oxygen	52.58
	100.00

The difference between the theoretical and actual results is plainly within the limits of error in analysis. In a letter with which Dr. Stenhouse has favoured me he says, "The characters of the substance analyzed were so similar in every respect to those of mannite, that I had scarcely any doubt upon the subject from the first." This is the only analysis, so far as I am aware, which has been made of the dandelion mannite, and for its performance we are indirectly indebted to the Messrs. Smith's labours. The merit, however, of first separating mannite from the dandelion-root-juice belongs to two German observers, Widnmann and Frickhinger. For a knowledge of this fact I am indebted to Dr. Christison, who was led by their researches to include mannite among the constituents of the plant under notice. Widnmann and Frickhinger's observations are contained in Buchner's "Repertorium für die Pharmacie, for 1841;"* and those of the Pharmacien first mentioned go back to the year 1832. They appear to have identified the mannite solely by its physical characters, as no analysis of the substance is referred to. Their researches, however, which were prosecuted separately, were lengthened and elaborate, and each was led as the result of his inquiry to the conclusion that mannite does not pre-exist in the plant, but is produced in the watery infusion of the root, by what they term "a kind of fermentation" out of the sugar, inulin, and other hydrates of carbon, which exist ready formed in the plant. The question whether mannite is an educt of the processes to which the root is subjected, *i.e.*, a pre-existent ingredient which is merely dissolved out of the plant by solvents such as water or alcohol, or a product of the transforming influence of these reagents, which at certain temperatures determine its generation out of easily modified organic substances, is one of interest to vegetable physiology as well as to chemistry. Dr. Buchner, in reviewing the labours of Widnmann and Frickhinger, says, in reference to their conclusion that the mannite is not pre-existent in the dandelion, "It would certainly be no useless labour to subject this result to further proof, with a view to discover whether in any case the mannite may be found ready formed in the root; and in addition to inquire what are the causes which transmute the sugar in so simple a way, and in such quantity, into mannite."—*Repertorium für die Pharmacie*, 1841, pp. 79, 80.)

The Messrs. Smith accordingly have thought it desirable to investigate this question, to which, however, it is due to them to mention, their attention had been directed before they were made aware of the researches which had been carried on in Germany. The scale on which they have experimented, and the efficiency of the apparatus with which their trials were made, give great value to their results. Their object was to ascertain whether, by the rapid action of solvents on the fresh root, it was possible to extract from it mannite, which might in that case be regarded as a ready-formed ingredient of the dandelion; and, on the other hand, to observe whether the infusion of the root, if left to itself for some time, underwent fermentation, during which the mannite was developed.

With a view to secure the phenomena anticipated being witnesssed on a scale which should make the experiment thoroughly crucial, two stout men, provided with spades of a very convenient shape, were employed to dig the roots, which they were desired to collect as rapidly as possible, so that there might be no time for the roots to become chemically altered before they were subjected to analysis. The diggers did their work so expeditiously that in two hours they returned with eighty pounds of fresh dandelion roots. Of this quantity forty pounds were immediately comminuted, and rapidly exhausted of their more soluble constituents by cold water percolated through their divided mass. The infusion thus procured was without delay transferred to a vacuum-still, concentrated to the consistence of a syrup, and thereafter mingled with alcohol. It was then left to cool, as in the successful process for the extraction of mannite from the root mentioned at the beginning of the paper.

The whole operations were so quickly managed that, from the commencement of the digging of the roots till the liquid was in full ebullition in vacuo, only six hours elapsed. From the alcoholic tincture or extract finally procured by this process not a trace of mannite could be obtained; but sugar which readily underwent the vinous fermentation was found in considerable quantity.

The second portion of the roots, consisting, like the first, of forty pounds, was comminuted and left in contact with cold water for three days. During this period the infusion was not observed to rise in temperature; but a constant escape of gas occurred, rising in bubbles through the liquid. The latter in addition became strongly

* Read before the Royal Society of Edinburgh on the 19th of February, 1849, by Dr. Wilson, Lecturer on Chemistry, Edinburgh.

* Widnmann's observations are contained in Buchner's "Repertorium," vol. xliii., part 2, page 281, 1832. Frickhinger's paper, to which Dr. Buchner's remarks are appended, was published in the "Repertorium," 2d series, vol. xxiii., part 6, pages 45 to 82, 1840.

acid, a character almost quite absent from the infusion of the previous experiment, in which also no effervescence of gas appeared. The fermenting infusion was transferred to the vacuum-still, and was otherwise treated as the former infusion had been.

The extract it afforded contained a large amount of mannite. The liquid which distilled over into the receiver was sour, and contained acetic acid. The contents of the still were also sour, probably from the presence of lactic acid.

The experiments recorded seem decidedly to warrant the conclusion that mannite does not exist ready formed in the root of the dandelion. Messrs. Smith, however, from an anxiety to obviate any fallacy which might have escaped them in the first of the two experiments just recorded, repeated it a second time with fully more despatch than before. The result was exactly the same. No mannite could be extracted from the unfermented cold infusion. But when the roots, even after the prolonged percolation of cold water through them, were left in contact with a fresh portion of that liquid for a single night, the resulting very weak infusion gave distinct though necessarily minute traces of mannite.

Messrs. Smith's observations, then, completely confirm those of Widnmann and Frickhinger, and the general statement that the dandelion "contains" mannite must be changed into "yields mannite."

The inquiry, however, has a wider bearing than the mere settlement of the question whether dandelion contains ready-formed mannite or not. This saccharoid substance has been separated from the juices or exudations of the Fraxinus ornus, the Eucalyptus mannifera, the cherry, the apple, the plum, the larch; from the root of celery, from several species of mushrooms, and of seaweeds, &c. There can be little doubt that mannite exists ready formed in some of those plants, but the question at least requires consideration.

The dandelion infusion is not a solitary example of a vegetable juice originally free from mannite having that substance developed in it by fermentation. The attention of continental chemists was early directed to this fact from the great losses which frequently attend the manufacture of sugar from beet-root, in consequence of the root-juice undergoing a peculiar fermentation, during which the sugar disappears, and is replaced in greater part by mannite, lactic acid, and a substance identical in composition with gum arabic. The fermentation is sometimes called the lactic or mannite, but more frequently the mucous or viscous, fermentation. It occurs spontaneously in saccharine vegetable juices exposed to the air at a temperature between 86° and 104° F., and may be produced at will in solutions of pure cane-sugar, by maintaining them at the temperature mentioned in contact with boiled yeast, the gluten of wheat, or the curd of milk.

In the natural juices, vegetable albumen, or one of the analogous azotized principles, acts as a ferment after decomposition has commenced in it, in consequence of its partial oxidation. The change is believed to be as follows:—If cane-sugar (hydrated $C^{12}\,H^{11}\,O^{11}$) be present, it is first by the appropriation of an atom of HO converted into hydrous grape-sugar $C^{12}\,H^{12}\,O^{12}$. This, by the abstraction of an atom of oxygen, yields one equivalent of mannite and one of lactic acid, thus—

Grape-sugar	$C^{12}\,H^{12}\,O^{12}$
Mannite	$C^{6}\,H^{7}\,O^{6}$
Lactic acid	$C^{6}\,H^{5}\,O^{5}$
	$C^{12}\,H^{12}\,O^{11}$

The lost equivalent of oxygen is probably spent in oxidizing the azotized principle, which then compels the sugar to undergo the change described. Gum being isomeric with cane-sugar, an alteration of the molecular arrangement of the latter may suffice to account for its production.

This sugar, which exists in the fresh dandelion, is probably cane-sugar, but its exact nature has not been ascertained by any of the observers whose names I have mentioned. It is thought probable, however, by Widnmann, and the Messrs. Smith have likewise arrived at the conclusion, that the dandelion mannite is not derived solely from the sugar of the root, but also from the inulin (one of the varieties of starch) $C^{24}\,H^{21}\,O^{21}$, which it contains. As inulin differs from cane-sugar only by containing half an equivalent less of water, this seems probable enough; and other members of the amylaceous or hydrate of carbon series of vegetable principles may also be supposed to be susceptible of the mannite fermentation. The question might be determined so far by ascertaining the quantity of sugar pre-existing in the root, and comparing it with the quantity of mannite produced by fermentation. No such quantitative analyses have been made; but the Messrs. Smith, although they cannot adduce numerical data in support of their conclusion, are strongly of opinion that the proportion of sugar existing, ready formed, in the dandelion, is much too small to account for the large quantity of mannite derivable by fermentation from the root.

From all that has been stated it will appear that it may be a question whether mannite exists ready formed in any of the vegetables that yield it; and that probably some of them, at least, afford it only as a secondary product. This is especially likely to be the case when the substance, like manna, exudes in the liquid state, and is exposed for some time to the modifying influence of the air. Should it prove in some cases, as seems likely, to be certainly produced during the life of the plant, some interesting questions may arise as to the mode of its formation, and the purpose which it serves. The azotized principle diastase, which converts starch into sugar, and is believed to play so important a part during germination by exposure to the air, acquires the power of converting sugar into mannite, gum, and lactic acid. It may, after oxidation, effect a similar transformation in mature plants, and be the cause of those abundant exudations of gum and manna which characterize some botanical genera. Lactic acid is not found in recent vegetables, but its place may be supplied by another acid, or none may be generated. Such speculations, however, are as yet premature.

[A beautiful specimen of mannite, obtained from the juice of the taraxacum by the Messrs. Smith, was exhibited by Dr. Pereira, at the conversazione of the Pharmaceutical Society on Jan. 17, 1849.

Messrs. Smith have subsequently forwarded to London specimens of mannite crystallized between glass plates. They are beautiful objects when examined by the polarizing microscope.—*Ed. Pharm. Journ.*]

ON ANHYDROUS NITRIC ACID.

By M. DEVILLE,

Professor of the Faculty of Sciences of Besançon.

(*Presented to the Academy by M. Dumas, in the name of M. Deville.*)

M. Deville has recently made a series of researches on the action of chlorine on the anhydrous salts of silver, with organic and inorganic acids.

In the course of his investigations M. Deville succeeded to produce anhydrous nitric acid by the action of perfectly dry chlorine on nitrate of silver. That the new substance was really anhydrous nitric acid, was proved beyond doubt by the concordant results of numerous analyses. The anhydrous nitric acid is obtained in beautiful, colourless, perfectly limpid, and brilliant crystals, which may be procured of considerable size. When slowly deposited in a current of refrigerated gas, their edges are a centimeter in length. They have the form of six-sided prisms, derived apparently from a right prism with rhombic base. They fuse at a temperature not much above 85.5 Fahrenheit; their boiling point is about 113° Fahrenheit. At 50° the tension of the anhydrous nitric acid is very considerable. In contact with water it becomes very hot, and dissolves in the liquid without imparting the slightest shade of colour to the solution; nor is the solution attended with disengagement of gas. Upon the addition of water of baryta to the liquid the nitrate of that base is obtained. When heated to about 110° to 113° (the boiling point), it suffers decomposition, which circumstance forms an obstacle to the determination of the density of its vapour by Dumas's process.

M. Deville's process for the preparation of anhydrous nitric acid is very simple; the only difficulty—and this is but trifling—lies in the construction of the requisite apparatus, since, from the facility with which the anhydrous nitric acid penetrates caoutchouc tubes, it becomes necessary to unite the several glass tubes composing the apparatus by fusion in the blowpipe flame. The process is as follows:—

M. Deville takes a U-shaped tube, capable of holding 500 grammes of nitrate of silver (dried in the apparatus at 356° F. in a current of dry carbonic acid gas). With this tube is connected another very large-sized U-shaped tube, having at the lower end a small reservoir attached to it; it is in this reservoir that the excessively volatile liquid (nitrous acid?) which invariably forms during the process is deposited. The tube with the nitrate of silver is immersed in water covered with a thin layer of oil, and heated by means of a spirit-lamp communicating with a reservoir at a constant level. The chlorine issues from a glass gasometer, its displacement being effected by a slow and constant flow of concentrated sulphuric acid. The current of chlorine gas is passed over chloride of calcium, and subsequently over pumicestone moistened with sulphuric acid. As long as the nitrate of silver is maintained at the common temperature no effect is apparently produced. But upon heating the nitrate to 203° F., and reducing the temperature again quickly to 156° or 154° F. (but not lower), a reaction becomes manifest. At the commencement hyponitrous acid is produced, which may be readily recognised from its colour and the readiness with which it condenses. When the temperature has reached the lowest point (156° or 154° F.), the formation of crystals begins, and continues so briskly that the receiver (which is to be kept cooled down to 6° below zero) is speedily choked with them. The crystals are invariably deposited upon that part of the receiver which is not immersed in the freezing mixture. M. Deville states that the latter need not necessarily be excessively cold; he found that even common ice will answer the purpose.

The gases are coloured, and the bulb of the cooled tube contains a small quantity of liquid, which must be removed from the apparatus before the transfer of the nitric acid to another vessel; to effect this, the current of chlorine is replaced by one of carbonic acid. The application of cold to the condenser is now stopped, and the vessel intended to receive the crystals is immersed in a freezing mixture, and joined to the producing apparatus by means of a caoutchouc tube lined with amianthus.

The current of the chlorine gas should be slow—at the rate of about three or four quarts in twenty-four hours. The whole of the gas is not, however, absorbed by the nitrate of silver. A certain amount of oxygen, apparently equal to the volume of chlorine employed, is evolved in the process.

The apparatus operates day and night without requiring attendance, except as regards the replenishing of the spirit-lamp when needed, and the occasional supply of a fresh quantity of the ingredients of the freezing mixture, and of the sulphuric acid which is employed for the purpose of effecting the displacement of the chlorine.

M. Deville promises us a more complete memoir hereafter, in which he will describe the chemical properties of the anhydrous nitric acid, and details the result of his researches on the

action of chlorine and hypochlorous acid on the salts of silver.—*L'Institut*, Feb. 21, 1849.

ON THE CRYSTALLIZED PHOSPHATES OF LIME AND OF PROTOXIDE OF MANGANESE.

By Dr. C. BÖDEKER.

I.—PHOSPHATE OF LIME.

Precipitate a solution of chloride of calcium with phosphate of soda slightly in excess, divide the fluid with the precipitate in it into two equal parts, to the one of which add an exact sufficiency of nitric or hydrochloric acid to redissolve the precipitate without the aid of heat; add now the other half (with the precipitate still in it) to the acidified solution, and let the mixture stand at rest in the cold for forty-eight hours; you will speedily observe that the amorphous precipitate of phosphate of lime suffers a change. It acquires greater compactness, and assumes gradually the appearance of delicate white spangles, which, after having been carefully washed with water, are found to contain neither nitric (or hydrochloric) acid, nor soda, but simply lime, phosphoric acid, and water. In many instances the spangles exhibit a fine silky or satinet lustre, and are of greater breadth than the usual product. Microscopic inspection shows them to consist of thin, tabular, four-sided, rhombic prisms, mostly with truncated edges, which imparts to the crystals the appearance of irregular six-sided tables. Drying over chloride of calcium or sulphuric acid does not reduce the weight of the salt to any perceptible extent.

When boiled with water the salt undergoes decomposition; it loses its compactness of structure, becomes opaque, and acquires an indistinct crystalline appearance; at the same time a solution of acid phosphate of lime is obtained, which reacts strongly on litmus paper, and yields with basic oxalate of ammonia a copious precipitate. (A mixture of the salt with cold water fails to react upon tincture of litmus; and it is only after lengthened ebullition of the mixture of the salt, water, and tincture, that a red tint makes its appearance.)

I analyzed the salt after drying it over chloride of calcium.

The analysis gave the following results:—

I. 0.2812 grm. of crystallized phosphate of lime lost upon ignition 0.0728 grm. of water = 25.89 per cent.

II. 0.530 grm. of another sample lost upon ignition 0.139 grm. of water = 26.22 per cent.

III. 0.530 grm. of the salt were ignited in the usual way, and the residue subsequently digested with concentrated sulphuric acid and mixed with 85 per cent. of spirits of wine, and washed. The residuary ignited, and neutral gypsum weighed 0.4183 grm. This corresponds to 32.56 per cent. of lime.

In the drying of the salt I found that four fifths of the water are expelled at 302° Fahrenheit, whereas the expulsion of the last fifth requires the application of a very intense heat, little short, indeed, of the ignition of the salt.

This department, and the results of the preceding analyses, lead to the formula:—

$$PO_5 + \left\{ \begin{matrix} 2CaO \\ HO \end{matrix} \right. + 4\,Aq.$$

	Calculated.		Found.	
2CaO	703.30	32.60	32.56	
5HO	562 40	26.06	26.22	25.89
PO_5	892.04	41.34	41.22 (from the loss)	
	2157.74	100.00	100.00	

II.—PHOSPHATE OF PROTOXIDE OF MANGANESE.

Precipitate a solution of protosulphate of manganese with phosphate of soda in excess, and proceed exactly in the same manner as described sub. I. for the preparation of the crystallized phosphate of lime, and you will obtain the crystallized phosphate of protoxide of manganese in almost colourless tables of glassy lustre. (The only appearance of colour which these crystals exhibit is an exceedingly faint light red.) These crystals appear, even to the naked eye, as tabular, straight, four-sided, rhombic prisms, mostly with truncated edges, which imparts to them the appearance of irregular, six-sided tablets.

Upon ebullition with water the crystals suffer decomposition, being, like the lime-salt, resolved into a soluble acid and an insoluble basic salt.

Both the phosphate of lime and the phosphate of protoxide of manganese fuse readily before the blowpipe with apparent ebullition: the fused phosphate of lime forms a white, opaque mass; the phosphate of protoxide of manganese a dark brown ball or button.

Drying over chloride of calcium does not reduce the weight of the phosphate of protoxide of manganese to a perceptible extent.

The analysis of the salt proved the absence of sulphuric acid, hydrochloric acid, and soda.

The quantity of water and of protoxide of manganese contained in the salt was determined in the direct way; the amount of phosphoric acid was calculated from the loss.

The air-dried salt lost nothing at 176° F.

At 230° F. 0.4091 grm. of the crystals lost 0.0952 grm. of water, equal to	23.27 per cent.
Upon subsequent ignition they lost in addition to this 0.0327 grm. of water, equal to.....	7.99 per cent.
The amount of water is accordingly	31.26 per cent.

The residue was dissolved in hydrochloric acid; some perchloride of iron and acetate of soda was added to the solution, and the mixture boiled. After the removal of the phosphoric acid, by means of the peroxide of iron, the protoxide of manganese was precipitated with oxalate of potass and some carbonate of soda. The ignited Mn_3O_4 weighed 0.1533 grm. Accordingly MnO = 34.86 per cent.

This corresponds to the formula:—

$$PO_5 + \left\{ \begin{matrix} 2\,MnO \\ HO \end{matrix} \right. + 6\,Aq.$$

	Calculated.		Found.
2 Mn O. ...	889.37	34.62	34.86
7 HO	787.36	30.65	31.26
PO_5	892.04	34.73	33.88
	2568.77	100.00	100.00

—*Liebig's Annalen*, Feb., 1849.

THOUGHTS ON ANCIENT METALLURGY AND MINING IN BRIGANTIA AND OTHER PARTS OF BRITAIN, SUGGESTED BY A PAGE OF PLINY'S NATURAL HISTORY.

By JOHN PHILLIPS, Esq., F.R.S., F.G.S.*

To one who meditates on the progress of natural knowledge, the difficulty of penetrating to a true estimate of its condition in past ages often appears unconquerable, except in cases which admit of the interpretation of ancient results by modern laws and theories. Once in firm possession of such laws, we enclose the old phenomena, so to speak, in a field to which are only such and such possible avenues, and thus can sometimes declare the very mode by which the alchemist was led to his golden error, and the Chaldæan shepherds to brighter truths. Without this principle of interpretation, many almost modern writers, nay authors of this very century, can sometimes not be understood. The laws of modern geology and zoology, for such there are, and well-founded too, are as much required to put a true construction on some of the writings of Lister and Linnæus, as the methods of Ray, Linnæus, and Cuvier are required for the just estimation of Aristotle. We shall probably find the darkest pages of antiquity to be precisely those which refer to subjects where our own knowledge is least clear, least collected into laws of phenomena, and most removed from laws of causation. Ought we not, before declaiming on the ignorance of the ancients, to be careful to make allowance for the differences of form in which knowledge presents itself at different periods, as well as for the incompleteness of their records, and the imperfection of our interpretations?

Pliny's Natural History appears to me to be precisely in the position of difficulty which has been already alluded to. Its vastness, variety, and seeming disorder, may well deter the most comprehensive master of modern science from duly weighing its mass, or even measuring its surface; and the evident incompleteness and almost haphazard character of its chapters are apt to disgust the student of special branches of science and art. Yet, probably, if for each important branch of human knowledge handled by Pliny, a special editor were set to work, well-versed in the philosophy of his subject, Pliny would take a higher degree on examination, and the history of human knowledge be amended.

From the thirty-seven books of diffuse and erudite learning, the genuine work of Pliny the elder, let us fix on the part which treats of the nature of metals; and passing over his lamentations on the useless excess of gold and silver—which may be recommended to the Chancellor of the Exchequer—his accounts of the uses and properties of gold, electrum,* chrysocolla, silver, quicksilver, stibium, scoria, argenti, spuma argenti, minium, cinnabar, brass, cadmium, iron, and many compounds of metals, let us pause at the 16th chapter of the 34th book, which treats of the metals of lead, white and black:—

"The most precious of these, the white, is called by the Greeks *Kassiteros*, and fabulously declared to be sought for in isles of the Atlantic, to which it is brought in wicker vessels, covered with leather (vitilibus navigiis corio circumsutis). But now it is ascertained to be indigenous in Lusitania and Galicia, in sandy surface soil, of a black colour, and only distinguished by its weight. Small pebbles (of the ore) also occur principally in dried beds of streams. The miners (metallici) wash these sands, and what subsides they melt in furnaces.

"It is also found with the gold ores (aurariis metallis) which are called stream works (elutia), the stream of water washing out (eluente) black pebbles a little varied with white, and of the same weight as the gold. On this account, in the vessels in which the gold is collected, these pebbles remain with it; afterwards they are separated in the chimneys† (caminis separantur), and, being melted, are resolved into plumbum album.

"In Gallicia plumbum nigrum is not made because the adjoining Cantabria [Asturias] so much abounds in that metal.

"Not out of white plumbum as out of the black can silver be extracted.

"To solder together [pieces of] plumbum nigrum is impracticable without [the use of] white plumbum, nor the white to the black without the addition of oil. Nor can [pieces of] white plumbum be soldered together without the aid of the black metal.

"That [plumbum] album was in esteem during the Trojan time Homer is witness, who calls it *kassiteros*.

"Of plumbum nigrum the source is double: either it comes from its own vein, without admixture, or grows with silver, and is melted while mixed with that metal. The part which is first liquid is called stannum,‡ that which flows next is silver, that which remains in the furnace galena,§ which is the third portion of

* From the Proceedings of the Yorkshire Philosophical Society for March, 1848.

* Gold with one fifth of silver.

† What distinctive meaning should be attached to furnaces and camini is uncertain. It seems that the camini may indicate, if not what we call chimneys, at least cavities in or above the furnace.

‡ Analogous to this is the process of separating silvery lead from mere lead, invented by H. L. Pattison, Esq.

§ Lib. xxxiv., cap. 18. Est et molybdæna, quam alibi galenam vocavimus, plumbi et argenti vena communis.

the vein (or ore). This being again melted* yields plumbum nigrum, [the other] two parts [of the ore] being deducted."

This chapter is a text on which a 38th book of Natural History might be written, embracing the history or fable of the *kassiterides*, the ancient arts of metallurgy, and the eager trade in metals which allured the Phœnician sailors on the Atlantic, and led the Roman armies to Britain.

What is *kassiteros*, for which plumbum album is the equivalent? what is stannum, obtained from mixed ores of silver and lead? what is galena, elsewhere called molybdæna? (cap. 18.) We need not ask what is plumbum nigrum, for by that is clearly designated lead.

That *kassiteros* or *kattiteros* was tin appears to be generally allowed. The mineralogist and miner, who know the mode of occurrence and character of tin ore, will have no doubt that plumbum album of Pliny is tin, and that author twice positively and expressly identifies this with *kassiteros*.

The uses to which Homer puts *kassiteros* in the thoraca and shields of Agamemnon, Achilles, and Asteropæus, and in the greaves of Achilles, are such as imply easy fusibility and ductility, and indicate that the metal was highly valued and almost precious.

Virgil puts no tin into the arms of Æneas; perhaps the metal was then of too vulgar use, employed too much by tinkers, to be fit for a heroic shield. Electrum is substituted, and iron is the staple article in the Vulcanian workshop, as brass was in that of Hephaistos, 1,000 years before.

The picture of the great artist—the Tubal Cain of the West, the cunning worker in metal, who melted, alloyed, inlaid, carved, and polished his work, whose multiplied bellows breathed at the will of the god softly or fiercely, whose brass was hardened to wound, or tempered to bend—is perfect, and might be parallel on a small scale till a few hundred years in the famous smiths of Wales, who made their own iron, and were by the laws of that country, as renewed by Howell Dda, allowed to sit next the sacred priest.

Why Pliny treats as a fable the story of the Cassiterides yielding tin is somewhat difficult to say. He classes the Cassiterides with Hispania, book iv., cap. xxii. (ex adverso sunt insulæ,—Cassiterides dictæ Græcis, a fertilitate plumbi), and speaks of Mictis (on the authority of Timæus the historian) as six days' sail from Britain, and as yielding candidum plumbum, iv., cap. 16. If the Cassiterides are the Ocrynian Promontory and the Scilly Isles, from which, as recorded by Strabo, the Phœnicians drew their tin (*Iktis* of Diodorus, *Miktis* of Timæus, and *Oyektis* of Ptolemy being Vectis or Wight, from which the tin was carried through France to Marseilles), we may suppose that in the early period the only route for the tin of Cornwall to the Mediterranean was by sea to the western parts of Spain; but that in the latter period the track by land through Gaul to Massilia was preferred, and the old trade had become a tradition which Pliny chose not to adopt from Strabo, who is never quoted on this subject by the author of the "Historia Naturalis," but may be obliquely and slightingly alluded to. Whether tin occurs at all in any part of the Spanish Peninsula can hardly be doubtful after the assertion of Pliny. He had been procurator in Spain, and by his intimacy with Vespasian, must be supposed in position to learn much of Britain, from the despatches of Petilius Cerealis, Ostorious Scapula, and Agricola. But he was suffocated by the fumes of Vesuvius in 79, one year after the appointment of Agricola to Britain, and, for the greater part of his literary life, Britain was a scene of never-ending war and confusion. Besides this, the Cornish promontory appears to have been at no time much occupied by Roman stations, or traversed by roads; and it may be thought to have had then, as afterwards in Saxon and Norman times, a history and commerce quite distinct from and little known to the Belgic settlers in Albion. He might be mistaken respecting Britain, of which, perhaps, he could know only Albion; but his positive assurance of the occurrence of tin in Spain is confirmed by a passage in "Bowles's Natural History of Spain," and, as I hear from Mr. Kenrick, by a later German writer (Hopfensach); it occurs, in fact, according to one of our best books of mineralogy, in beds in the mica schist of Galicia. (W. Phillips, 1823.) Oxide of tin has been found, besides, on both sides of the Erzegebirge in granite, at Puy de Vignes (Haute Vienne), also in granite in Wicklow (granite), on the east coast of Sumatra, Siam and Pegu, and in Banca and Malacca. It has been found in Mexico, Chili, and Greenland, and mixed with other matters in Finland and Sweden.

Upon the whole the case is probably thus. It is the old Phœnician trade destroyed with Carthage, which Strabo describes, and Pub. Crassus went to explore in the *Cassiterides*. Diodorus Siculus narrates the course of trade in the days of Augustus from Ictis, when Gaul offered an easy route to the Mediterranean; but 100 years of war and commotion interrupted this trade of Cornwall with the East, and Pliny was suspicious of the fables of Greece, and knew that tin was obtained in Spain. Notwithstanding this fact, it appears that Cornwall and the Asiatic Isles have been the principal, almost the only, sources of the tin of the ancient world, that of Zinnwald being quite unknown till a much later date.

Stannum is evidently an alloy of an argentine or tine-like aspect—a variable pewter—a metal more easily melted than copper, for the lining of which it was much used in Pliny's days to obviate the danger of cupreous solutions. This process we now call tinning; and stannum, with its variable meanings, is perhaps the common parent of the French *étain*, meaning as often pewter as tin; and of the German *zinn*, which, like tin in the English workshops, is used sometimes for pewter when lining vessels, and solder when covering surfaces which are to be joined. Our German silver, Britannia metal, &c., belong to this class. The process of illination with stannum must have been well executed to justify the exclamation of Pliny, that it did not augment the weight of the vessel to which it was applied. The Brundisian specula made of it yielded to silver, indeed, at last; but they are declared to have been of admirable efficiency.

Stannum, then, is an alloy of tin with lead, tin with brass, tin with antimony, lead with silver, or other variable mixtures of metals often associated in nature.

Pliny mentions adulterate or alloyed kinds of stannum, composed of one part white brass to three parts of candidum plumbum; of equal weights of candidum and nigrum (which is called argentarium); of two parts of nigrum and one of candidum (called tertiarium); with this last lead pipes are soldered.* Fraudulent dealers add to the tertiarium equal parts of album, call it argentarium, and with it plate or line other metals.

He gives the prices of these compounds and those of pure album and nigrum; the former twenty, the latter seven, denarii for 100lbs.

Plumbum album, he says, is rather of an arid nature; the nigrum is entirely humid; "therefore the white is of no use unless it be mixed with another metal. Silver cannot be leaded with it, it will be melted first." "It is affirmed that if there be too little nigrum mixed with the album the silver will be corroded by it. Album is melted into brasswork (inlaid, an invention of Gaul), so that it can hardly be known from silver—these works are called Incoctilia" (silvered). He then speaks of the application of this invention to the trappings of horses and carriages, and other curious productions of Alesia and Bituriges, a subject which our esteemed Kenrick has lately handled with his usual felicity. One of Pliny's sentences is remarkable as narrating a class experiment fit for a chemical school: "Plumbi albi experimentum in charta est, ut liquefactum pondere videatur, non calore, rupisse."

The meaning seems to be, that the metal is fluid at so moderate a heat as when fused to break by its weight, not burn by its heat, the charta on which it is poured. Tin melts at 440° to 442°; lead at 612°.

What follows is a very important passage: "India neque æs neque plumbum habet, gemmisque suis ac margaritis hoc permutat."

May we be justified by this sentence in refusing to credit the supposition that tin (plumbum album) was brought overland or by other routes from the Asiatic Isles and shores towards Western Europe? If so, Cornwall chiefly, if not wholly, supplied the tin which entered so many ways into the comforts and necessities during peace and war of all the nations surrounding the Mediterranean and Euxine, Baltic and German Ocean; in fact, the world, as distinctly known to the Roman geographers.

Let us now inquire into the means whereby the ancient people reduced the metals which they were so earnest in seeking across mountains and oceans at the point of the sword. To confine the inquiry within reasonable limits, we shall speak chiefly of tin and lead, the only metallic products, as it appears, which were regarded by the ancients as abundant in Britain. [Iron is mentioned by Cæsar as of limited occurrence.]

Gold, the most widely if not most abundantly distributed metal—found near the surface of the earth, in a pure and malleable state, easily fused, uninjured by fusion—was probably the metallic substance on which the earliest processes of fire were tried, and they could not be tried unsuccessfully.

Tin, the ore of which has been found at the surface in many situations with auriferous sand and gravel, cannot have been long unknown to the gold-finders of the East and West. Some one of the many accidents which may or rather must have accompanied the melting of gold would disclose the nature of the accompanying white metal, whose brilliance, ductility, and very easy fusibility would soon give it value.

The melting of tin ore is, however, a step in advance of the fusion of native gold. The gold was fused in a crucible (xxxiii., p. 617, Hard.) made of white clay,* which only could stand the heat and the chemical actions which that generated; but tin ore would in this way of operation prove totally infusible. It must be exposed at once to heat and a free carbonaceous element. The easiest way of managing this is to try it on the open hearth. Perhaps some accidental fire in the half-buried bivouacs of the Damnonii may have yielded the precious secret. As to the fuel, we are told that pine woods were best for brass and iron (Hard., xxxiii., p. 621); but the Egyptian papyrus was also used, and straw was the approved fuel for gold. In the metalliferous country of Cornwall and Devon peat is plentiful; and an order of King John (1201) allows the miners to dig tin, and turves to melt the tin, anywhere in the moors, and in the fees of bishops, abbots, and earls, as they had been used and accustomed. (Confirmed by Edward I., Richard II., and Henry IV.†)

These and other singular privileges, extending as far as the lands on which the Crown claimed rights, are long anterior to the other rights of property in Cornwall, Mendip, Derbyshire, and the Forest of Dean, and go far to justify the supposition of our modern mining laws being a relic of Roman, or perhaps of earlier than Roman, times.

As the bellows was known at least one thousand years before Pliny, we have here all the materials for a successful tin-smelter's hearth. If the smelting work was on waste land, and a little sunk in the ground, we recognise the old "bole" or "bloomery" of Derbyshire, now only a traditional furnace, but anciently the only one for the lead and iron of that country.

Pure tin once obtained, there must intervene

* At the present day we should perform this melting of the residual "galena" in the slag-hearth, with a flux.

* Hoc fistulæ solidantur. This is the solder of our tinmen.

* Such as now is called Cornish clay, for example.
† De la Beche, in Report on Geology of Cornwall.

a long series of trials and errors before its effect in combination with lead, brass, silver, &c., could be known; before the mode of conquering the tendency to rust in the act of soldering could be discovered; oil being in this respect as valuable to the tinner as artificial chrysocolla was to the jeweller and goldsmith (xxxiii., p. 621, Hard.). From all this it follows that the smelting of tin might be, and probably was, performed by the inhabitants of the Cornish peninsula. This art they may have brought from the far East; Phœnicians may have taught it them; but all the accounts of the ancient tin trade represent the metal, and not the ore, as being carried away from the Cassiterides. Diodorus mentions the weight and cubical form of the tin in blocks carried from Ictis to Marseilles and Narbonne; and Pliny says of the Galician tin, that it was melted on the spot.

Did the Cornish or Galician miners make bronze? For this is generally the compound indicated by the Roman *æris metalla*, though it is undoubted that they also knew of and distinguished zinc brass. There is, I believe, no instance of a single bit of pure tin or pure copper being found with the numerous "celts," which occur in so many parts of England; nor is any other proof given that the direct union of tin and copper was effected by the natives of Britain. Copper is so abundant in Cornwall that it might tempt to the other hypothesis; but this copper is a sulphuret; it is found united to the sulphuret of iron in deep veins and in a matrix of quartz; and these are things which render the production of pure copper one of the most refined operations in smelting. Cæsar tells us the brass used by the natives of Britain was imported. Probably Cyprus,—colonized by the Phœnicians, to which old authors refer as the original source of brass,—Cyprus with its ancient copper mines (Tamassus), which has given its name to the metal, might be one of the points from which bronze radiated over the Grecian, Roman, and barbarian world. It was from Cinyras, the King of Cyprus, that Agamemnon received his splendid breastplate with twenty plates of tin, and its liberal additions of turquoise, lazulite or, rather, malachite, obtained perhaps from the soil of the island. (Pliny xxxiii., p. 633, Hard.)

The works of Hephaistos, the Crawshay of antiquity, may have been fixed on Lemnos on account of some volcanic appearances there; but the tradition shows at least that the various operations of refined metallurgy were not strangers to the islands of the Mediterranean; and the uniformity of design and composition in the ancient celts, chisels, makella, and instruments of war, implies a common, and that not a barbarous, origin. The perfection and variety and great proportions of the brasswork executed in the Grecian states and colonies may also be regarded as indicating the local seat of the early as well as the later art of working in bronze.

Lead was obtained in Spain and Gaul from deep and laborious mines (xxxiv., p. 669, Hard.), but so abundantly near the surface in Britain as to suggest a law for preventing more than a limited production—a Brigantian law of vend. The Romans employed lead in pipes (fistulæ) and sheets, which were soldered with alloys, as already mentioned. This lead was previously refined, and its silver removed, the silver, indeed, being often the object of the enterprise. How earnestly the silver was sought—how well the mining operations were carried on by the "old men"—appears from the notice of the Carthaginian mines in Spain, the pits and levels driven by Hannibal being mentioned as in wonderful preservation by Pliny. The same may be said of at least one set of mining works of Roman date in the extreme parts of South Wales, viz., the Gogofau, near Lampeter, where gold was extracted with much labour from broken and pounded quartz, of which enormous mounds remain. The adit still exists, and was lately entered by Sir H. T. De la Beche, who found in it a specimen of native gold. In the vicinity tradition indicates a Roman settlement; and a massive chain of gold and other remains were found, and are now possessed by the family of Johnes, of Abercothi.*

The districts in Britain, where lead veins coming to the surface in abundance might justify the praises of Pliny, are, in the south, Mendip; in the west, Flintshire, &c.; in the north, Derbyshire, Yorkshire, and Cumberland, that is to say, the Brigantian territory; and it is to this last district that the descriptions apply most correctly. Lead cast in Roman moulds, pigs, in fact, of the age of Hadrian and other emperors, have been found in Flintshire, Derbyshire, Yorkshire, and some other counties. But few ancient mining instruments have ever been found in the lead-bearing districts of Britain;† and I am strongly of opinion that much of the lead-ore was collected from the surface by aid of water, artificially directed. The process, in fact, is described by Pliny in terms so exactly applicable to the modern "hushes" of Swaledale, that no doubt can remain of this custom, which is now esteemed rude and semi-barbarous, being of Roman or earlier date in Britain.

As thus from Roman or earlier times our lead-mining derives its "hush," its levels, and shafts, implements for washing, and other processes of the workmen, and the forms, weights, and marks of its melted metal, we may easily admit a similar origin for the melting processes. Lead mostly occurs in the sulphuret, which offers no particular difficulty in the fire. By cautious roasting, its excess of sulphur may be removed, and the subsequent melting with charcoal, or a flux, be facilitated. Indeed, without roasting, and without flux in many cases, the lead will flow out of the ore, if placed among flaming wood or peat, and subjected to a sufficient stream of air.

But the use of fluxes could not long remain unknown in the limestone districts of Northumbria, or amid the fluoric veins of Derbyshire — limestone and fluor being to this day valuable aids in the furnace. Peat was the fuel in Cornwall, and still is in Yorkshire; and, perhaps, the Roman smelters did really erect their furnaces on waste ground and heaths at Dacre and Matlock, far from the mines of Greenhow and Youlgreave, even as is done at present with the cupolas of Lee and Langley mills.

The use of crucibles, bellows, cavities of some peculiar sort, perhaps chimneys, great variety of carbonaceous fuel, the power of purifying and alloying, and knowledge of the properties of alloys, appear quite conspicuous among the ancient arts.

The inscriptions on these masses of lead are in the same general form as the "marks" of the different mines now in work, and which, no doubt, are their literal and lineal descendants. Thus the Ald or Auld Gang mine of Swaledale, old in the days of the Saxons; the mines of Greenhow-hill, which supplied sheet and pipe lead for our baths and coffins at York, as well as tribute to the imperial treasury; the mines of Middleton and Youlgreave (Aldgroove), from which the Lutudæ sent not only lead, but "exargentate" (that is to say, refined) lead from which the silver had been removed, use to this day the pig of the same weight of 1¼ cwt., of similar shape and similar mark to that of eighteen hundred years' antiquity.‡ And, just as at the present day, the countryman whose galloway is tired drops the leaden load by the wayside, for another day's work, so in the days of Rome the Brigantian lead was thrown down from the tired caballus by the side of the ancient mining road on Matlock-moor, in Derbyshire, and Dacre-pasture, in Yorkshire.

The fact of the discovery of the Roman lead, not at the mines, but at a distance of some miles from them, on a track leading towards a Roman, or, rather, a Pre-Roman station, is of much importance in archæology. For thus we arrive, in the first place, at the conviction of the existence of very ancient roads, not of Roman work, nor probably of Roman, but of earlier date, leading toward Cataractonium, Isurium, Eburacum, Mancunium, Derventio, or, rather, to the Brigantian towns or centres of trade, on which the Romans, following their wont in Africa, Spain, and Gaul, fixed their attention and established their war camps and their colonies. The politic lords of the world broke up no national industry, set no legionaries to supplant the native miners, but stationing a few cohorts on the ancient roads, in or close to the mining district, as at Hope and Bainbridge, to control a rude population, received regularly the fruits of the industry which they might direct, but did not personally share. Viewed in this light, how complete appears the grasp of the Roman treasury on the mining fields of Britain! The Fossway from the Ocrynian promontory crosses the Mendip-hills—the road from Mancunium to Bremetonacum traverses the Calamine district of Bowland—the road from Derventio or Tutbury to Mancunium runs along the west of the great Derbyshire field, and the legionary path from Carlisle to York goes right across the metalliferous country of Yorkshire and Durham.

We may even ask, with some confidence, whether the line of the Hadrian wall, which cuts off from the north all the richest mines of the Derwent, the Allen, and the Tyne, but abandons the mossy dales of bleak Northumbria, was not drawn with especial reference to the mining wealth of the districts?

May we not regard, as a confirmation of all that has been advanced touching the antiquity of our mining processes, the fact of the existence to this day, though impaired by recent acts of Parliament, of peculiar rights and privileges in the mining districts? These rights are sometimes guaranteed by and appear to emanate from royal charters, as in the stanneries of Cornwall and Devon; but they are probably of far earlier date, and have merely been confirmed as old customs by John and his successors. In Mendip, the Forest of Dean, and Derbyshire, the miners' rights were preserved by royal officers, but the rights themselves transcend all history and tradition. To sink a pit or drive a level in any field, to cover the rich herbage with barren ore-stuff, to cut a way to the public road, to divert, employ, and waste the running waters, and to do all this without consent of owner, and without compensation being so much as asked by lord or villein, landlord or tenant, implies in Derbyshire a settlement of mining rights long anterior to "Domesday Book," the charters of Repton Abbey,* the neighing of the Saxon horse, and the flight of the Roman eagle. In connection with all that has been mentioned before—the furnaces, the roads, the restricted vend, the foreign trade—they seem to me to indicate a people who came with many inventions from the metalliferous east to the metalliferous

* See Sir R. I. Murchison's remarks on Gogofau ("Sil. Syst.," pp. 367, 368).

† Sir R. I. Murchison mentions Roman mining utensils at Shelve, in Shropshire (Sil Syst., p. 279).

‡ The modern pig is made near to $\frac{2\,8\,2\,0}{1\,6}$ of a fodder, or 176¼ lbs. Three Roman pigs found near Matlock in 1777, 1783, 1787, weighed 173, 126, and 84 lbs., these being as 1, ¾, and ½ of the modern pig.

* The mines in the neighbourhood of Wirksworth were wrought before the year 714; at which period that district belonged to the nunnery at Repton, over which Eadburga, the daughter of Adulph, King of the East Angles, presided as abbess. In that year the abbess sent to Croyland, in Lincolnshire, for the interment of St. Guthlac, who was originally a monk of Repton, a sarcophagus of lead lined with linen (plumbum lintheumque). This lead was obtained from the possessions of the old Saxon religious establishments at Repton, part of which were the mines near Wirksworth. In the year 835, Kenawara, then abbess of the same nunnery, made a grant to Humbert, the alderman, in which she surrenders that estate of mines, called Wircesworth, on condition that he gives annually, as a rent to Archbishop Ceolnoth, lead to the value of three hundred shillings, for the use of Christ's Church, Canterbury. On the destruction of the religious houses by the Danes in 874 it is probable that the lead mines became the property of the Crown. As such they are mentioned in "Domesday Book."—*Glover's Derbyshire*, vol. i., p. 73.

west, before the Athenians drew silver from Laurion or the Carthaginians from Iberia.

To these ancient, these Semitic mining processes we have added, perhaps, steel instruments, and certainly explosive agents; the ore-hearth still remains, but it is generally yielding to the reverberatory furnace; silver is no longer obtained by oxidation of some thousand times its weight of lead; steam blows our furnace fires, rolls and pipes our metals, and flies with iron wings on roads more solid than the Appian Way. The world of George Stephenson is much different from that of Julius Agricola; but some features of the past remain to connect the earliest with the latest aspect of our country; and among these the least altered, and the most instructive, appear to be the mineral products and the mining processes. If by these we judge the great Brigantian tribes which surrounded Isurium, they must be placed far higher on the scale of civilization than the place usually accorded by the Saxon to the Celt.

I presume to think, indeed, that without full attention to the mining history of Britain, as indicated by fragments in classic authors, and illustrated by processes not yet extinct, the opinion which may be formed of the ancient British people would be altogether conjectural, derogatory, and erroneous.

BREAD FOR DIABETIC PATIENTS.

By Dr. PERCY, F.R.S.

It appears to be now generally admitted that, in the treatment of diabetes mellitus, amylaceous matter should in a greater or less degree be excluded from the diet. But, as is well known, under such restriction of food the diabetic patient soon becomes weary of the ordinary kinds of azotized matter, as beef, mutton, &c. Hence various substitutes for common bread have been proposed. Some years ago my friend, Mr. Morson, of Southampton-row, London, prepared, at my request, specimens of bread containing gluten in various proportions. However, the result was not satisfactory;* it was only relished by the patient when it contained a considerable quantity of starch, and when the proportion of gluten was increased beyond a certain amount it became so tough and tenacious as to be very difficult of mastication. I have also made trial of gluten bread brought from Paris by Mr. Morson, but with no better success. Recently Dr. Prout has published a receipt for a kind of bread devised by his patient, the late Rev. J. Rigg (vide "Stomach and Renal Diseases," 5th edit., p. 44); and this is probably the best substitute for common bread which has hitherto been proposed. Some time ago Mr. Charles F. Palmer of this town prepared for me with great care, specimens of bread from Dr. Prout's receipt; but patients to whom it was given complained of the difficulty in swallowing it, owing to the large quantity of bran which it contained. Mr. Palmer then suggested the matter of rasped potatoes, left after the complete removal of the starch by washing, to replace the bran. He carried the suggestion into practice, and produced a kind of bread which I think well deserves the attention of the profession. It has been extensively employed in the General Hospital of this town, especially by my friends Dr. James Johnstone and Dr. Fletcher, and also by several private practitioners, with decided advantage. In composition it may be considered as Mr. Rigg's bread, in which the bran has been replaced by the residual matter of the potato above mentioned. And the fact of its being rendered light and porous by hydrochloric acid and carbonate of soda, precisely as in the preparation of Dodson's unfermented bread, it is, as must be obvious, an expensive article; but with many diabetic patients this will not be an object of consideration. It is improved in taste by being slightly toasted and eaten warm. I here subjoin Mr. Palmer's receipt:—

"Take the lingneous matter of sixteen pounds of potatoes washed free from starch, three quarters of a pound of mutton suet, half a pound of fresh butter, twelve eggs, half an ounce of carbonate of soda, and two ounces of dilute hydrochloric acid. This quantity to be divided into eight cakes, and in a quick oven baked until nicely browned. At first gum arabic in sensible quantity was also introduced into this bread, on the ground of the assertion of Professor Graham, that when that substance is taken by the diabetic patient the proportion of sugar evolved from his system is not thereby increased, and that, consequently, it might probably supply matter for pulmonary oxidation. However, it was found that it rendered the bread tenacious and disagreeable; so that its use was subsequently abandoned. I wish it to be understood that whatever merit there may be in the production of this bread it is entirely due to Mr. C. F. Palmer. My friend Dr. Evans suggests, and I think with reason, that this bread would probably be improved by the addition of a certain proportion of bran. Some gluten might also be added with advantage."—*Chemical Gazette.*

* I do not mean by this to assert that bread deprived of a portion of its starch is not preferable to common bread for diabetic patients.

ON THE PREPARATION OF ETHIOP'S MINERAL.

By M. C. VOGLER.

The usual method of preparing Ethiop's mineral consists in triturating the mercury and sulphur together in a marble or porcelain mortar. The mixture is sprinkled from time to time with water or spirit of wine while the trituration is continued, until globules of mercury can no longer be discovered by means of a magnifying glass. This process is objectionable in a practical point of view, for, as the mixture becomes dry from the evaporation of the liquid employed, the dust is diffused through the atmosphere, and not only is there loss of product, but the operator suffers inconvenience from the inhalation of mercurial vapours. These evils may be obviated by adopting the following method of effecting the combination:—The mercury is put into a strong stoppered bottle with one fourth of its weight of sulphur. These are shaken together for about two hours, more sulphur is then added, and the agitation continued until combination is completed. The process is conducted in this way in a shorter time, and with less inconvenience, than that which is usually adopted.—*Archiv. der Pharmacie.*

ON THE SEEDS OF THE RICINIS COMMUNIS.

By M. CALLOND.

M. Callond has been engaged for several years in the examination of the seeds of the *Ricinus communis*, or castor-oil plant. It is well known that these seeds yield a mild purgative oil (castor oil); but the mark from which the oil has been pressed retains an emetico-cathartic principle which the author considers to possess much interest. The castor-seeds, administered in doses of one or two drachms, either in their natural state, or made into an emulsion, generally produce hypercatharsis accompanied by vomiting. The mark or residue from which the oil has been pressed operates with nearly the same energy as the seeds in their natural state, from which it has been inferred that the mild expressed oil owes its purgative property to the presence of a minute quantity of the active principle alluded to. It has even been supposed that the purgative principle was an oleo-resinous body. M. Callond affirms that this principle possesses neither the character of an oil nor of a resin. The following are the experiments upon which this assertion is founded:—

1. After having expressed the oil from the seeds by a powerful pressure the mark was treated with pure alcohol, and the filtered liquor submitted to spontaneous evaporation. The oily residue, administered in different doses, was found to have the same action as the expressed oil.

2. After having exhausted the seeds of everything soluble in boiling alcohol, the residual mark, when administered to the extent of seven or eight grains in a glass of sweetened water, produced nausea and salivation, which continued for more than six hours. Thirty grains, administered in two doses to a young man of strong constitution, caused vomiting, accompanied by much straining, for nearly twenty-four hours.

M. Callond is still engaged in these investigations.—*Journ. de Pharm.*

THE CHEMICAL TIMES.

SATURDAY, APRIL 7, 1849.

OUR OWN SERIES.

No. VIII.

ON CHEMICAL MANIPULATION;

Lutes and Luting.

Since the extended application of indiarubber to the purposes of connecting pieces of chemical apparatus, the number of lutes, formerly so important a matter to chemistry, has been very much diminished. Nevertheless, there are occasions in which indiarubber is not applicable, not so much, however, in the laboratory of the analytical chemist as in that of the manufacturer and pharmacien. Next to indiarubber, the mode of luting most generally useful consists in the circumvolution of small strips of pigs or bullocks' bladder, previously steeped in water until they have become soft. In order to use this lute with the greatest possible effect, the bladder should be steeped until the commencement of incipient putridity. This fact, known so well to the conservators of anatomical museums, can seldom be taken advantage of by the chemist, who will most probably be unable to spare the necessary time. This lute possesses the advantage of sticking readily to a wet piece of apparatus, which idiarubber will not do. Another very good lute, which may be employed in all cases where the former is eligible, consists of portions, in the form of strips, of cloth or silk, evenly smeared with a coating of white of egg, intimately beaten up with finely-sifted quicklime. If the surface to be luted be large, so so that the expense of white of eggs becomes an object, the serum of bullocks' blood may be substituted. In fact, a mixture of bullocks' blood and lime constitutes the very powerful cement used by coppersmiths for the purpose of rendering watertight the rivet-holes of their manufactured vessels, and it has occasionally been employed as a mortar in the construction of certain old fortifications.

Another very good extemporaneous lute is linseed meal intimately beaten up with milk or water until a paste is formed, and applied on cloth. Glaziers' putty, also, is a luting material which the practical chemist on the large scale will occasionally find of value.

The foregoing substances, which may be called extemporaneous lutes, will answer for an infinity of purposes to which lutes are employed as a means of joining apparatus together. But there is another use to which lutes are applied,

and to which the bodies already mentioned are totally unadapted, namely, as materials for the coating or reinforcement of retorts, crucibles, and other vessels which are to be exposed to the agency of high temperatures.

For such purposes, if the maximum of infusibility be required, the best substance that can be employed is Stourbridge clay. If merely a red heat have to be withstood, a mixture of Stourbridge clay and sand or powdered glass is preferable, and in either case the lute will be all the better if it be accurately commingled with some hay cut in lengths of not more than a quarter of an inch.

In the application of lutes as a coating to glass vessels, the following directions should be accurately observed, and the experimenter should studiously avoid anything like carelessness or a slovenly manner of application, which assuredly would render all his future labours in vain.

Supposing a flask or retort to be covered with a coating of clay, or clay and sand or powdered glass, the following process should be followed, inasmuch as there is some difficulty in getting a layer of either of these materials to attach itself to a glass surface. The latter should be prepared by dipping it into a thin mixture of clay-water and gum-arabic mucilage; the vessel should then be allowed to dry. The lute should then be prepared as follows:—

Let the clay be reduced to a condition of fine powder, intimately mingled whilst in powder with cuttings of hay (cow-dung will do as well), and sand or powdered glass if either is to be used. Next add water by degrees, and beat the whole into a tenacious cake. This part of the operation is most important; and half an hour will be scarcely too much time to be devoted to the accurate mixture of four pounds of material. When sufficiently mingled, and reduced to a tenacious mass, the latter should be rolled or beaten out upon a flat surface, and cut into strips, which latter should be pressed against the vessel to be coated until they perfectly adhere.

At the points of junction between two or more strips, care should be taken to produce an accurate incorporation by pressure and rubbing of the luting; indeed, it is generally well in the performance of this operation to join the edges of two or more plates of the luting material by a process of bevelling or sloping, which may be accomplished by slightly moistening the edges with water, and pressing them out by the finger or a piece of wood.

As an appendix to general remarks on lutes and luting, we cannot better minister to the necessities of our readers than by appending a list of the most useful of these bodies, with incidental directions for their use, from the "Treatise on Chemical Manipulation" by Faraday:—

"*Stourbridge Clay.*—It should be ground to fine powder; is highly useful in coating retorts, tubes, &c., and in effecting junctions between crucibles and their stands. It sustains a higher heat than any other English lute.

"*Windsor Loam.*—It is a natural mixture of clay and sand in such proportions as to make an excellent lute, though it will not resist the heat sustained by Stourbridge clay. It is frequently used for the lining of furnaces, pots, &c.

"*Willis's Lute.*—When earthenware retorts are required to be rendered impervious to air or vapours, Mr. Willis directs that an ounce of borax be dissolved in half a pint of boiling water, and as much slacked lime added as will make it into a thin paste. This is to be spread over the retort with a brush, and when dry a coating is to be applied of slacked lime and linseed oil beaten together until it becomes plastic. This will dry sufficiently in a day or two, and is then fit for use. Earthenware retorts thus prepared may be used, it is said, several times with safety, the coating of lime and oil being renewed each time.

"Mixtures of pulverized borax with the clay lutes above described, or with common clay, form fusible fluxes, which are often useful in glazing over the surfaces of vessels so as to close their pores. About one tenth by weight of borax is sufficient for the purpose. The mixture made into a thick paste with water may be laid on with a brush, and the vessel should be handled carefully until the heat has attained redness, lest the slightly-adhering crust should be knocked off previous to its fusion.

"*Fat Lute* is applied to the junctions of apparatus which are liable to considerable elevation of temperature, or to prevent the escape of corrosive vapours. It is prepared by beating dried and finely-pulverized clay (pipeclay or Cornish clay) with drying linseed oil until the mixture be soft and ductile. It is to be closely applied to the junction intended to be made tight, the glass or other substance being first wiped perfectly dry. If the joint has to sustain heat the lute will soften; it then requires to be confined by strips of bladder, which being put round it should be tied tightly above and below the mass of lute, and afterwards two or three turns of twine passed round the middle part. When moisture or vapours escape between this lute and the vessel it is very difficult to close the leak, and hence the great importance of making a dry tight joint at the commencement. Glazier's putty resembles fat lute, and may be used for similar purposes.

"*Parker's Cement* is a brown powder, which should be preserved for use out of contact with the air. When mixed with water into a thin paste it gradually sets, and becomes quite solid and hard. It may be used occasionally with advantage in making joints tight, either at common or moderately high temperatures. It may be rendered quite tight by being brushed over with a melted mixture of equal parts of wax and oil. It resists a red heat sufficiently well to make it a useful coating for glass retorts or tubes upon numerous occasions.

"*Plaster of Paris*, when mixed into a thick cream or thin paste with water, sets after a short time and becomes solid. It is best mixed by putting a little water into a cup, sprinkling the powder into it, pouring off the excess of water, and stirring the mixture. It may be used for the same purposes as Parker's or Roman cement, being generally superior to it in convenience; and may be made air-tight in the same way by washing it with oil, or wax and oil, and should also be preserved from the air when in powder. When plaster of paris is mixed up with very weak glue instead of water it is somewhat longer before it solidifies, but ultimately makes a very hard and strong lute.

"A lute of plaster of Paris may be raised to dull red heat without injury, but if oiled or waxed, to prevent the passage of vapours, it will not support so high a temperature unchanged.

"*Caustic Lime*, mixed with various mineral and vegetable substances in solution, affords numerous cements and lutes, which, when dry, are hard, and impervious to vapours. The lime should be well burned, and slaked with just sufficient water to make it fall into a dry powder; after which it should be preserved in a close bottle until wanted. One of the most powerful of these cements is obtained by using white of egg diluted with its bulk of water. The fluids are to be beaten together until the mixture pours with perfect liquidity. This is best effected by means of a little stick made to rotate by rolling it between the hands, and having at its lower end a cross piece, the arms of which, when in motion and immersed in the liquids, effectually mix them. This being done, the dry slacked lime in powder is to be added by sprinkling in such quantities that the whole, when mixed, shall have the consistency of thin paste. This should be done quickly, after which the mixture should be put upon slips of cloth and applied round the junction to be luted, and a little of the dry lime should be sprinkled over the exterior. The substance soon hardens and adheres strongly.

"This cement is often conveniently applied by moistening slips of cloth with white of egg beaten up without the addition of water, and then sprinkling the lime in powder over it in such quantity as to make a moist paste on the cloth. The slips should be immediately applied to the junction, a little lime being shaken over the exterior.

"In place of white of egg a moderately strong solution of glue may be used; or the serum of blood; or diluted blood; or a mixture made by rubbing down very poor cheese with water in a mortar until of the consistence of cream.

"If a leak take place through or by one of these lime lutes during an operation, no difficulty occurs in stopping it by the application of a fresh portion of the lute, which adheres readily and perfectly, and is not liable to the difficulty which occurs with fat lute. They will bear a heat approaching to visible ignition without injury.

"*Iron Cement.*—This mixture is used for making permanent joints, generally between surfaces of iron. Clean iron borings, or turnings, are to be slightly pounded, so as to be broken but not pulverized; the result is to be sifted coarsely, mixed up with powdered sal ammoniac and sulphur, and enough water to moisten the whole slightly. It is then to be rammed or caulked into the joints, and the latter drawn together as tightly as possible. The proportions are, 1 sulphur, 2 sal ammoniac, 80 iron; and no more should be mixed than can be used at once.

"*White Lead* ground up with oil, when spread upon slips of cloth, is very useful for making joints tight, especially those of metal, glass, or other tubes. The lead, when laid on the cloth, should be made to penetrate it.

"*Paste and Paper* are frequently useful in making joints. The paste should be well boiled and thick. It is better to use bibulous than sized paper, for the paste more freely enters its pores and incorporates with it, and the joint is less permeable; but from the greater tenderness of such paper when moist more care is required in handling the pasted slips and applying them.

"Paper which has been pasted, and has been allowed to dry without having been folded together, is very useful in the laboratory. A slip of it moistened on the pasted side and allowed to soak for a few moments is ready for application to a joint, or in any other situation where its adhesive powers may be useful. It is also very convenient for making labels to be attached to bottles and glasses the instant they are required.

"Paper prepared with a mixture of wax and turpentine is also very useful for many of these purposes, especially the labelling of bottles.

"*Glue* with paper makes a very useful and convenient application. With cloth it makes a strong one, which may be rendered nearly tight by an exterior fold of paper; and quite tight if the joint, when dry, is brushed over with drying oil, or drying oil and wax.

"*Linseed Meal*, or *Almond Paste*, well beaten up with water until of an uniform and proper consistence, is an excellent lute for cold joints of glass, or metal apparatus. It should be applied thickly, and will then adhere well: it will in some hours become a hard mass, and will resist most vapours; but water must not be allowed to run upon it, either within or without the joint. It will not bear a heat above 600° F. When made up with milk, lime-water, or weak

glue, it becomes firm sooner, and forms a harder substance than when water alone is used."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Joseph Lillie, of Manchester, engineer, for certain machinery or apparatus applicable for purifying and cooling liquids, and for purifying, condensing, and cooling gases. Patent dated September 21st, 1848. Enrolled March 21st, 1849.

This specification relates to certain new and improved methods of cooling liquids, and condensing, purifying, and cooling gaseous bodies. The first and principal of these methods the patentee proposes to apply for the purpose of cooling the heated wort in the process of brewing and for other like purposes. It consists in passing the heated liquid into a perforated vessel, which may either be made to revolve or may be kept stationary, according to circumstances, and as may happen to be required; the liquid passes through the perforations in the sides of the vessel, and thence descends in a divided state in the form of rain into a vat or receptacle below; by this means the temperature of the liquid is very considerably reduced. The apparatus which the patentee proposes to use for this purpose is illustrated by several engravings which accompany the specification. A distributing-vessel is fixed to a vertical shaft, the lower end of which rests in a step-piece fixed to the bottom of a vat or receiver. The upper end of the shaft turns in a bearing bolted to a beam, which may be fixed to the walls of the building, or secured in any other convenient way, upon the upper end of the vertical shaft. Above the bearing are two ordinary fast and loose pullies, such as are usually employed for driving machinery. The lower of these fast-pullies being driven by means of a strap from any convenient first-mover, a rotary motion will be given to the vertical shaft and the perforated distributor. The distributor may be formed of any convenient material, such as sheet metal for instance, and of any convenient form. The surface is closely perforated with small holes or fine slits, or it may be made of wire gauze. A pipe conveys the heated wort or other liquid to be cooled to the distributor, which latter is provided with a stop-cock, for the purpose of regulating or entirely suspending the supply of heated liquid to it. The receiver may, if required, be made with a second bottom, some little distance below the first bottom. The liquid, after having reached the first bottom, is allowed to pass through holes in it, and falls on to the lower bottom, from whence it is conveyed away by any convenient means. The vapours arising from the heated liquid passing through the apparatus may be drawn off by a drawing apparatus placed above it, the vapour passing into a shallow conical head or receiver, from whence it is drawn through a passage by the action of a rotary fan. This apparatus acts in the following manner: — The driving-strap being shifted on to the fast-pulley, a revolving motion is communicated to the vertical shaft and the distributor; the stopcock in the supply-pipe is now opened, by which the heated liquid flows into the distributor, whence, by the action of the centrifugal force, the liquid creeps or moves up the sides of the distributor and passes outward through the perforations in a divided state, falling into the receiver below in the form of rain, passing, of course, through the atmosphere in its fall. For the purpose of preventing the liquid in the distributor from rising too far up the sides of it by the centrifugal action, and thus flowing over it, the upper edge of the distributor is made with a return flange or edge, projecting inwards towards the centre, thus stopping all further movement upward of the liquid when it reaches that point. The patentee states that, by the operation of this apparatus, the distributor revolving at a proper speed, and a fall of about eight feet being given to the liquid, the temperature of the latter is reduced from the boiling point to about the temperature of the surrounding atmosphere. The patentee sometimes modifies the construction by making the distributor consist of two perforated vessels instead of one; these two vessels are of unequal sizes, the smaller one being placed within the larger; the heated liquid is conveyed into the inner vessel, and passes through the perforations therein into the space between the two vessels, and thence through the perforations of the outer vessel down into the receiver; this arrangement is for the purpose of extracting any extraneous matter from the liquid more effectually than if one distributing vessel only were used. The inner distributing vessel has a rotary movement communicated to it independent of the movement of the outer distributor; the movements, also, of the two distributing vessels may be as stated by the patentee, either in the same or in opposite directions, and at the same or different velocities. The patentee describes a modification of the above-mentioned arrangement and construction, in which the distributor does not revolve, but is permanently fixed over the receiver or vat, and the heated liquid to be cooled is conveyed into the distributor through a vertical pipe from a reservoir or vessel above; the pressure of the column of liquid in the pipe being sufficient to cause it to pass through the perforations in the distributor with a considerable force, sufficiently strong to cause it to descend into the vat or receiver in a divided manner, as in the foregoing arrangement, thus producing precisely or nearly the same effect, but by means of pressure in lieu of centrifugal force.

The apparatus by which the patentee proposes to effect the purification, condensation, and cooling of gaseous matters is very similar to the preceding; the receiver being, in this case, a cylinder, closed at the top by a cover. The distributor is secured to the end of a pipe, which passes vertically through a stuffing-box in the cover of the cylinder. The upper end of the pipe is attached, by means of a stuffing-box, to another pipe, which conveys the heated liquid to the distributor. Upon this vertical pipe, between the stuffing-box upon the cylinder cover and the stuffing-box upon the pipe, is fixed a pulley, by which rotary motion is communicated to the pipe, and consequently to the distributor. The cold water, or other condensing medium, is passed through the pipes into the distributor, from whence it is passed outward through the perforations by the centrifugal force, as before described, and descends to the bottom in a finely-divided state, passing through the gas to be operated upon, which is forced through the cylinder in the following manner:—The gas is conveyed by a pipe into the cylinder at the centre of the bottom plate, the end of it rising up a few inches within the cylinder. There is a false bottom within the cylinder, fixed at a short distance above the ingress gas-pipe. This bottom is perforated over its surface, except the part immediately above the gas-pipe. This perforated bottom is for the purpose of dividing the gas passing through the cylinder into a number of small jets, for its more effectual purification and condensation. The gas, after passing through the descending shower of the purifying medium, is carried off from the top of the cylinder by another pipe; there is a pipe for carrying off the purifying medium, after it has descended to the bottom of the cylinder; the purifying medium employed is lime and water or some similar material. There may be one, two, or more of these cylinders and apparatus employed, as may happen to be required, for effectually purifying the gas, which passes successively through them; the purifying medium may also be repeatedly used if desirable. The patentee, also, describes another mode of effecting the same object. This consists in placing within a closed vessel the water or other purifying medium, and conveying the gas through it in the following manner:—A vertical pipe passes down into the vessel through a stuffing-box on its top; the lower end of this pipe is divided into two branches at right angles to the vertical pipe; the outer ends of the branches are curved, so that, when rotary motion is given to the vertical pipe, the apertures from the branches are in a plane with their motion; of course the branches are below the surface of the water. Upon the upper end of the vertical pipe outside the vessel a pulley is fixed for giving the rotary motion to it, rapid motion being given to the vertical pipe by the action of the revolving branches; a partial vacuum would be formed in them and the vertical pipe; but the atmospheric air or other gaseous substance employed rushes in and is carried rapidly through the water in the vessel, and passes out of the apertures at the branches. A pipe attached to the upper part of the vessel carries off the air or other gaseous substance after passing through the water. The patentee also proposes the employment of a combination of this last mode of producing a current of atmospheric air with the revolving distributor before described for the more effectually cooling the liquid descending from the distributor; this is effected by making the distributor-shaft hollow, and attaching the branches before spoken of to the lower end of it.

The patentee claims:—

First. The apparatus described for cooling liquids, by means of a revolving bowl, or distributing-vessel, pierced with many small holes, through which the liquid to be cooled is passed by the centrifugal force imparted, and is thus distributed in a divided state or in jets.

Secondly. The arrangement and combination of machinery described, whereby the liquid, which is distributed in a divided state, may be subjected to a current of air, or of other gaseous matters.

Thirdly. The arrangement and construction of apparatus described for the purpose of subjecting liquids by pressure when in a divided state to an artificial current of atmospheric air or of other gaseous matters.

Fourthly. The arrangement and construction of apparatus for the purifying, condensing, and cooling gases, as described.

Fifthly. The arrangement and construction of apparatus described for producing a current of air or of other gaseous matters, whether used alone or in combination with the centrifugal distributor before described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MARCH 28TH, 1849.

John Macintosh, of Bedford-square, for improvements in furnaces and machinery for obtaining power, and in regulating, measuring, and registering the flow of fluids and liquids. Patent dated March 24th, 1849; six months.

Alexander Parkes, of Harborne, in the county of Stafford, chemist, for improvements in the deposition and manufacture of certain metals, and alloys of metals, and improved modes of treating and working certain metals, and alloys of metals, and in the application of the same to various useful purposes. Patent dated March 26th, 1849; six months.

John Mason, of Rochdale, in the county of Lancaster, machine-maker, and George Collier, of Barnsley, in the county of York, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton, and other fibrous materials, and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same. Patent dated March 26th, 1849; six months.

Stephen White, of Victoria-place, Bury, New-road, Manchester, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of treating and consuming smoke; also improvements in furnaces for economizing heat, and in apparatus

for the consumption of gases. Patent dated March 26th, 1849; six months.

David Henderson, of the London Works, in the parish of Renfrew, Scotland, engineer, for improvements in the manufacture of metal castings. Patent dated March 26th, 1849; six months.

George Thomson, of Camden-road, cabinet-maker, and James Elms, of the New-road, gentleman, for improvements in macinery for cutting and tying up firewood. Patent dated March 28th, 1849; six months.

William Buckwell, of the artificial granite works, Battersea, civil engineer, for improvements in compressing or solidifying fuel and other materials. Patent dated March 28th, 1849; six months.

Richard Satchell, of Rockingham, in the county of Northampton, for improvements in machinery for depositing seeds, and hoeing and working land. Patent dated March 28th, 1849; six months.

Pierre Réné Guérin, of Havre, for improvements in steering ships and other vessels. Patent dated March 28th, 1849; six months.

Charles Green, of Birmingham, patent brass-tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of railway wheels. Patent dated March 28th, 1849; six months.

James Thompson Wilson, of Glasgow, for improvements in the manufacture of sulphuric acid and alum. Patent dated March 28th, 1849; six months.

George Henry Manton, of Dover-street, Piccadilly, gunmaker, and Josiah Harrington, of Regent-circus, gunmaker, for improvements in priming, and in apparatus for discharging, fire-arms. Patent dated March 28th, 1849; six months.

Frederick William Norton, of Lascelles-hall, Lepton, in the county of York, fancy cloth manufacturer, for certain improvements in the production of figured fabrics. Patent dated March 28th, 1849; six months.

François Vouillon, of Princes-street, Hanover-square, manufacturer, for improvements in making hats, caps, and bonnets. Patent dated March 28th, 1849; six months.

William Hartley, of Bury, in the county of Lancaster, engineer, for certain improvements in steam-engines. Patent dated March 28th, 1849; six months.

John Britten, of Birmingham, manufacturer, for certain improvements in the means, apparatus, and appliances for cooking, preserving, preparing, and storing drinks, and articles of food; and in preparing materials for constructing such apparatus; also in constructing vertical roasting-jacks, and chains for the same; parts of which improvements are applicable to other similar purposes. Patent dated March 28th, 1849; six months.

James Lawrence, the elder, of Colisbrooke, in the county of Middlesex, brewer, for an improvement or improvements in brewing worts for ale, porter, and other liquors, and in storing ale, porter, and other liquors. Patent dated March 28th, 1849; six months.

William Beckett, of Northwich, in the county of Chester, draper, and Samuel Powell, of Wilton, in the same county, foreman, for certain improvements in the manufacture, making, or construction of certain articles of wearing apparel. Patent dated March 28th, 1849; six months.

James Fletcher, of Salford, in the county of Lancaster, manager, and Thomas Fuller, of Salford, machinist and toolmaker, for certain improvements in machinery, tools, or apparatus for turning, boring, planing, and cutting metal and other materials. Patent dated March 28th, 1849; six months.

Osborne Reynolds, of Dedham, in the county of Essex, clerk, for certain improvements in railways. Patent dated March 28th, 1849; six months.

Thomas Harrison, of Liverpool, merchant, for certain improvements in the construction of baking-ovens, and also certain machinery for working or using the same. Patent dated March 28th, 1849; six months.

Henry Howard, of Railway-place, Fenchurch-street, in the city of London, for certain improvements in the manufacture of glass, also in the construction of furnaces for melting and fining the same. Patent dated March 28th, 1849; six months.

PATENTS RECENTLY EXPIRED.

W. Weekes, Kingstanley, clothier, for improved machinery for cleansing, planing, polishing, and dressing woollen and other cloths. Patent dated March 25th, 1835; expired March 25th, 1849.

J. Barker, Camberwell, for improvements in the construction of umbrellas and parasols. Patent dated March 25th, 1835; expired March 25th, 1849.

J. Berrie and D. Anderson, Glasgow, for certain machinery for making a new or improved description of headles or healds. Patent dated March 25th, 1835; expired March 25th, 1849.

J. Brunton, West Bromwich, for certain improvements in the construction of retorts for generating gas, for the purpose of illumination. Patent dated March 25th, 1835; expired March 25th, 1849.

W. Houlston, London, for certain improvements in tools, implements, or apparatus, which are either used in, or subservient to, the art of letterpress-printing. Patent dated March 25th, 1835; expired March 25th, 1849.

HARDENING OF GYPSUM.

It is well known that calcined gypsum, when moistened with a solution of alum, and recalcined, acquires an increase of hardness. Keating last year recommended the employment of a solution of one pound of borax in nine pounds of water. With this solution the calcined pieces of gypsum are to be moistened, then heated to redness for six hours, and powdered. The effect is said to be still better if one pound of tartar and twice as much water be added to the above solution.

From some experiments made by Erdmann it appears that Fuch's soluble glass (Wasserglas) is well adapted for hardening the surface of plaster of paris figures.—*Pharmaceutishes Central Blatt*, Aug. 30, 1848.

[The following is the formula for preparing Fuch's soluble glass:—

Take ten parts of carbonate of potash, fifteen parts of quartz (or sand free from iron and alumina), and one part of carbon: melt them together. The addition of carbon promotes the decomposition of the carbonate of potash. The resulting mass (silicate of potash) is soluble in four or five parts of boiling water; the solution by evaporation yields a transparent kind of glass, which is permanent in the air, and is somewhat harder than common glass. It is composed of silica 62, potash 26, and water 12=100. Applied to wood and other objects, it renders them incombustible.]

ON A YELLOW COLOURING MATTER IN CRUDE TARTAR.

A dyer of Leipsig discovered that he could make use of a certain sort of crude tartar, which had been imported from Italy, and was, from its outward appearance, not to be distinguished from the usual sorts, for dyeing yellow; and that it was in consequence of the yellow pigment contained in it that this tartar was not applicable for every colour. A sample of it was tried with ether and alcohol, which extracted but a trace of a colouring matter. In caustic potash and caustic ammonia the tartar dissolved and yielded a dark yellowish-brown colour, similar to that which the safflower assumes with potash. By maceration with carbonate of soda, the tartrate of potash could be extracted without dissolving the yellow pigment. From the impure sediment which remained behind after the application of carbonate of soda, ammonia, and especially potash ley, the pigment was extracted. On adding alum to the solution of the latter in potash, a pure and beautifully yellow-coloured aluminous earth fell down. The pigment changed, however, in the potash solution from the commencement of its becoming dissolved. It is very probable that some yellow pigment had been employed for colouring the wine, which deposited, and was thus enclosed by the tartar.—*Pharmaceutisches Central Blatt*, Jan. 26, 1848.

BIRTHS AND DEATHS IN LONDON DURING THE WEEK ENDING SATURDAY LAST.—The number of deaths during the week ending the 31st of March last was, according to the Registrar-General's return, 1,241, being 72 above the weekly average of the last five years. The excess in the return is said not to be caused by sudden increase of mortality, but to be due to an accumulation of coroners' cases, which occurred in previous weeks, though they were not registered till the end of the quarter. The number of those cases was 198, whereas the average number of inquests in a week is about 60. The number of persons who died in the week was about 1,100, being 69 below the average. Cholera has nearly disappeared from London, the deaths being only 4, viz.:—St. Pancras; Camden-town.—M. 7, brought from Drouet's establishment, at Tooting, in January, "malignant cholera, occurring to him at a time when he was suffering from insufficient diet and warmth of clothing, and impure air," inquest. Hackney; West Hackney.—F. 57, "natural death from cholera" (20 hours), inquest. Whitechapel; Mile-end New-town.—At Spring-gardens, M. 3, "died from malignant cholera," inquest. Poplar; Bow and Bromley.—In Henry-street, F. 9 months, "gastritis (3 days); cholera (2 days)."

TO CORRESPONDENTS.

☞ Notice to Correspondents.—The readers of the *Chemical Times* are informed that Dr. Scoffern (on account of other engagements) having ceased to edit this journal, all literary communications, queries, &c., should in future be addressed to the editor, 320, Strand.

"Chemicus."—The excellent patent air-pump represented in our number the week before last may be seen in action, or purchased from Messrs. George Knight and Sons, philosophical instrument makers, Foster-lane, Cheapside.

"A Subscriber" is referred to No. 126.

"J. T."—Nitric acid, specific gravity 1.38.

"B. R. W."—Your offer was very liberal. Do not increase it. We do not think the parties have it in their power to put you to such very considerable trouble and expense as they threaten. To us the whole affair seems a most shameful atttempt at extortion.

"J. L. S."—Yes; next week.

"J. B., Sheffield."—Break the bones to pieces, and put the latter into small cast-iron pots, varying from ¾ to ½ of an inch in thickness. Place every two and two of these pots (filled with the bones) dextrously with their mouths together, and lute with loam. Place a number of pots (from 100 to 130) thus prepared side by side, and over each other in an oven resembling a potter's kiln. Kindle the fire, and keep up a strong heat for from ten to twelve hours. Allow the pots and their contents to cool before opening the former.

"Mr. Wilson, Liverpool."—The red bronze powder is prepared as follows:—Mix together 100 parts of sulphate of copper, and 60 parts of carbonate of soda. Apply heat to the mixture until the two ingredients unite into a mass. Let this cool, and reduce it subsequently to powder, to which add 15 parts of copper filings. Mix the copper filings intimately with the powder, and heat the mixture to whiteness; keep it at a white heat for twenty minutes. Cool the mass, reduce it to powder, wash, and dry.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary and scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—April 7, 1849.

ORIGINAL SERIES.

LECTURES ON ORGANIC CHEMISTRY.

By Dr. SHERIDAN MUSPRATT,
Professor to the Liverpool College of Chemistry, Author of numerous Chemical Works, &c.

LECTURE XI.

The interesting results obtained in the toluole series of compounds lead us to another group, some time ago investigated, *i.e.*, styrole from liquid storax. The gum discharges from crevices in the bark of the Styrax officinalis, a small tree growing in the Levant and cultivated in the southern parts of Europe. Drs. Blyth and Hofmann give the following particulars with regard to the gum and the hydrocarbon obtained from it:—The material they employed for the preparation of the styrole was that known under the name "liquid storax." It had a dark grey colour, and soft consistence at the ordinary temperature, but was hard and brittle at 0° C. It possessed a strong aromatic odour, and was so abundant in oil that it could be squeezed out with the fingers. The liquid storax was distilled in a copper retort with some carbonate of soda, to retain any cinnamic acid. A milky liquid passed over, on the surface of which floated a layer of transparent oil. The experimenters found the quantity of oil to vary much, owing to a certain decomposition taking place in the balsam when kept for any length of time. Forty-one pounds of liquid storax gave about twelve ounces of styrole. In a second distillation twenty-seven pounds did not give more than three ounces. They should have produced nearly eight to agree with the first operation. The styrole is easily purified by digesting it over chloride of calcium, and submitting it to distillation several times. In its pure state it is a colourless mobile oil, refracting light strongly. Its boiling point is 146°. Styrole is very slightly dissolved by water, easily by alcohol, wood-spirit, acetone, sulphide of carbon, fatty and ethereal oils.

Formula:—

$$\frac{C_{16}\,H_8}{\text{Styrole.}}$$

differing from toluole by two equivalents of carbon:—

$$\frac{C_{14}\,H_5}{\text{Toluole.}}$$

Nitrostyrole is most difficult to obtain. This is somewhat remarkable, for the nitrobenzole and nitrotoluole, which I have prepared in large quantities, are easy of production. By acting upon benzole or toluole with fuming nitric acid, decomposition immediately occurs, and on the addition of water the desired oily compound deposits. To obtain nitrostyrole, common nitric acid and styrole must be repeatedly distilled with certain precautions, a detailed account of which will be found in the author's excellent paper, "Liebig's Annalen, for March, 1845," page 298. The nitrated bodies resulting from benzole, toluole, and styrole, are here exhibited for the purpose of showing the striking analogy:—

Nitrobenzole ..... $C_{12}\left\{\begin{matrix}H_5\\NO_4\end{matrix}\right\}$

Nitrotoluole ..... $C_{14}\left\{\begin{matrix}H_7\\NO_4\end{matrix}\right\}$

Nitrostyrole ..... $C_{16}\left\{\begin{matrix}H_7\\NO_4\end{matrix}\right\}$

When bromine is added to styrole great heat is evolved, and it is changed into a crystalline matter—bromostyrole, possessing a characteristic odour. The crystals are insoluble in water, but they impart to it the peculiar penetrating smell. They dissolve copiously, however, in alcohol and ether, and are reobtained in a pure state by slowly evaporating either of the menstrua. Before dissolving the crystals in alcohol they should be well affused with water to take away any adhering impurities. I shall place before you the formula:—

$$\frac{C_{16}\,H_8\,Br_2}{\text{Bromostyrole.}}$$

We have direct combination, no hydrobromic acid being formed.

Chlorine forms an analagous compound, which is liquid:—

$$\frac{C_{16}\,H_8\,Cl_2}{\text{Chlorostyrole.}}$$

The most remarkable feature with regard to styrole is its conversion by heat into an isomeric modification—metastyrole, a transparent solid body. Here is a portion of it that has been heated in this sealed tube. The metastyrole, you perceive, appears like the glass. Its refractive powers are so high that it may eventually become serviceable to the optician.

When Simon worked upon these bodies he noticed the extraordinary change that took place on heating styrole, but he supposed that a portion of it had absorbed oxygen, and was converted into oxide of styrole. This, however, was not the case. The singular metamorphosis takes place without loss or addition to any of its elements, solely through a calorie change in its molecular structure. Metastyrole is inodorous and tasteless. It is quite hard, and can be cut by the knife.

Formula:—

$C_{14}\,H_7$.

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LI.

(LECTURE LXXIX.)

TANNIN OR TANNIC ACID.

Tannin is a principle very largely diffused through the vegetable kingdom. It is characterized principally by its astringent taste, and its property of striking a deep blue, black, or green precipitate with persalts of iron.

The tannin extracted from gallnuts is the only specimen of this principle that has been thoroughly studied.

Tannin is represented by the formula:—

$$C_{18}\,H_8\,O_{12}.$$

It is a solid, non-crystalline, colourless, and inodorous substance; its taste is purely astringent without bitterness; it reddens litmus paper. It is largely soluble in water. In alcohol it dissolves the more readily in proportion as the alcohol is more highly diluted with water. In ether it dissolves only to a very trifling extent.

When exposed to the air a solution of tannic acid gradually absorbs oxygen, an equal volume of carbonic acid is evolved, the liquid turns turbid, and deposits a crystalline matter of grey colour; this deposit consists almost wholly of gallic acid. Besides carbonic acid and gallic acid, water is formed in the process of decomposition which the tannic acid undergoes upon exposure of its solution to the air.

Tannic acid is sufficiently powerful to decompose the carbonates. The compounds which it forms with the alkaline bases are exceedingly liable to suffer alteration when exposed to the air.

Tannic acid precipitates nearly all the metallic salts. It is one of its most marked peculiarities that it does not affect the protosalts of iron, whilst it strikes a deep blue precipitate with the persalt of the same metal.

Tannic acid precipitates also all the salts with vegeto-alkaline bases, forming with the latter compounds sparingly soluble in water, but very readily soluble in acetic acid.

Most of the mineral acids precipitate the tannin from its aqueous solution, forming with it sparingly soluble compounds.

Skin removes the tannin from its aqueous solution, and is thereby converted into leather.

With solution of gelatine tannin yields a white flaky precipitate (tanno-gelatine), which redissolves in an excess of gelatine. Upon addition of tannin in excess, the tanno-gelatine is deposited again in the form of a brown and elastic matter.

Tannin precipitates equally the other animalized substances, such as albumen, caseïn, &c.

For the process of preparing tannin we refer the reader to the chapter on gallnuts.

The tannin which is respectively found in divers families of plants is by no means identic. There are several different species of tannin, just as we have different species of sugar, gum, &c.

With respect to the action which they exercise upon the salts of iron, the different sorts of tannin may be divided into two classes, viz.:—

1. Tannin which strikes a deep blue precipitate with persalt of iron; *e.g.*, the tannin derived from gallnuts, from the bark of the oak-tree, from sumach, the alder-tree, the birch-tree, &c. &c.

2. Tannin which strikes a green precipitate with persalt of iron; *e.g.*, the tannin derived from Peruvian bark, catechu, kino, tea, the pine and fir trees.

In medicine we use the pure tannin extracted from gallnuts. We make equally use, however, in many instances, of substances which contain tannin in natural association with other principles. These substances are usually prepared for administration by simply reducing them to powder, that is, of course, if the matters associated with the tannin do not bear too preponderating a proportion with respect to the latter. Catechu, kino, gallnuts, and red roses may be thus prepared for administration to the patient by simple reduction to powder.

The soluble astringent parts are extracted with water, by simple maceration, if the solution is intended ulteriorly to serve for the preparation of a syrup or extract; or by infusion, if the solution is intended for a drink, or requires to be kept a certain lengthened period of time. If the substances treated contain both starch and tannin, ebullition must be carefully avoided; in cases where this precaution is neglected, the liquid gets turbid upon cooling; this is owing to the circumstance that at a temperature above 122° F. a soluble compound of starch and tannin is formed, which, being insoluble in water at a lower temperature, is deposited upon the subsequent refrigeration of the liquid. The roots of patientia, tormentil, and snakeweed present this phenomenon.

By the evaporation of the solutions resulting from the action of water upon substances containing tannin, extracts are obtained consisting of tannin associated with several other principles.

These solutions may also be converted into syrups, in which case it is a matter of the greatest importance for the success of the operation to avoid clarification by means of the whites of eggs, since the albumen and tannin would separate in the form of an insoluble flocculent precipitate. The best way is to procure a concentrated solution, and to add this to the boiling syrup, which latter also should be concentrated previously by evaporation.

As I have already stated, tannin dissolves in alcohol the more readily in proportion to the degree of dilution of the latter. To prepare alcoholic tinctures of tannin substances with highly rectified alcohol would, accordingly, be the very reverse of a proper proceeding. Alcohol of 56 Cent. will answer the purpose very well.

Wine and vinegar are proper solvents for tannin; but not so ether and the fatty bodies.

A certain number of tannin substances owe the whole of their properties to the tannin which they enclose; others contain, at the same time, essential oil, which adds its own action to that of the tannin. We may accordingly divide the tannin substances into two classes, viz.:—

1. Substances which owe their properties exclusively to the tannin which they contain.

2. Substances which contain tannin and essential oil, and owe their properties to both these ingredients.

It should be borne in mind, moreover, with regard to this point, that tannin does not invariably manifest the same properties irrespective of the substances from which it has been derived; so, on the other hand, the substances which owe their properties to the tannin cannot be expected to manifest identical properties, although, of course, there will always be observed a considerable analogy of properties between them. Accordingly it would be very wrong, indeed, to use and substitute them indiscriminately for each other. The astringent action of gallnuts, for instance, is of a different character from that of catechu, of the root of the pomegranate, or of the red rose; hence certain special applications of each and either of these several substances.

Section I.—SUBSTANCES WHICH OWE THEIR PROPERTIES TO THE TANNIN WHICH THEY CONTAIN.

These may be subdivided into several groups:—

1. GALLNUTS.
2. JUICES CHARGED WITH TANNIN.
   - Catechu,
   - Kino,
   - The juices of the acacias.
3. ROOTS CHARGED WITH TANNIN.
   - Ratanhia,
   - Snakeweed,
   - Tormentil (seafoil).
4. BARKS CHARGED WITH TANNIN.
   - The bark of the oak-tree,
   - The bark of the root of the pomegranate-tree,
   - The bark of monesia (Chrysophyllum glycyphyllum).
5. LEAVES CHARGED WITH TANNIN.
   - Briar leaves,
   - Myrtle leaves,
   - Liverwort leaves,
   - Sumach tops.
6. FLOWERS CHARGED WITH TANNIN.
   - The flowers of Brayera anthelmintica,
   - Red roses.
7. FRUITS CHARGED WITH TANNIN.
   - Acorns,
   - Peel of the pomegranate.

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1. GALLNUTS.

Gallnuts are excrescences found upon the leaves and leavestalk of a species of oak, called Quercus tinctoria s. infectoria. They are produced in consequence of the puncture of the female of the gallwarp, Cynips quercus tinctoriæ.

The gallnut is composed of

Tannin (about)	65.
Gallic, ellagic, and luteogallic acids	4.
Chlorophyle and volatile oil	0.7
Extractive matter	2.5
Gum	2.5
Starch	2.
Lignin	10.5
Liquid sugar, albumen, divers salts (gallates of potass and lime, &c.)	1.3
Water	11.5
	100.0

Besides these substances gallnuts contain, according to Berzelius, a little pectic acid in combination with tannin.

The luteogallic acid is the yellow colouring principle of gallnuts; it is, like ellagic acid, insoluble in water, alcohol, and ether.

The tannin of gallnuts has been most carefully examined by M. Pelouze. We have already described its properties.

Pelouze's process of preparing tannin from gallnuts is as follows:—

Put into a long narrow glass adapter-tube, closed at the lower end with a cotton wick, a quantity of finely-pounded galls sufficient to fill about one half of the tube; press the powder very gently down. Insert the tapering end of the tube into a matras or bottle, fill the empty upper half of the tube with sulphuric ether of commerce, close with a ground glass stopper, and leave the apparatus to itself.

Next day the bottle will be found to contain two distinct layers of liquid, of which the upper one is very limpid; the lower one syrupy and amber-coloured. Add fresh ether until the volume of the lower and denser layer ceases to increase. Pour the two liquids now into a funnel closed with the finger, and, after waiting a few instants to give time for the separation of the two layers, run the lower and denser liquid steadily off into a capsule. (The upper layer remaining in the funnel may be distilled with a view to recover the greater proportion of the ether used.)

Wash the dense liquid in the capsule repeatedly with pure ether, and evaporate it subsequently in a stove, when copious vapours of ether and a little aqueous vapour will be disengaged from it. The matter swells up considerably, and leaves a light, spongy, crystalline residue behind, which is sometimes colourless, but mostly of a faintly yellowish hue.

It happens sometimes that the ethereal liquid deposits only a small quantity of syrupy matter; in such cases M. Liebig proposes to add a little water to the liquid, and to shake the mixture, when the tannin will form a hydrate with the water, and subside to the bottom.

M. Leconte has proposed to substitute the process of expression for that of lixiviation. This modification has been almost universally adopted by the manufacturers of tannin. It was found, however, that the operation did not always succeed equally well; this induced M. Dominé to study the subject carefully. This gentleman found that the presence of a certain quantity of water is indispensable for the success of the process. The tannin, the water, and a rather large proportion of the ether, enter into an association which effects the separation of the whole of the tannin in the form of a syrupy liquid, insoluble in ether.

The following is M. Dominé's modification of M. Leconte's process:—

Reduce gallnuts to powder, and keep this for three or four days in a cellar where it may absorb moisture. Put the moist powder into a wide-mouthed vessel, and add a sufficiency of ether to form a soft paste or dough. Close the vessel now hermetically, and leave it standing at rest for twenty-four hours. Arrange a piece of thick linen (ticking will answer best) just large enough to enclose the paste, open the flask, withdraw the contents, and form them with the aid of the linen into a cake of the greatest possible evenness. Subject the cake to the action of the press. You will obtain a certain quantity of matter of greater or less consistence (varying from that of honey to that of a thick syrup), according to the less or greater quantity of ether used. Withdraw the cake from the press, scrape off the tannin which adheres to its surface, and pulverize the mass of the cake between your fingers. Introduce the powder again into the vessel, and make into a paste with a mixture of 100 parts of ether at 56 Cent., with six parts of water (these two fluids should be shaken together briskly, and the mixture be poured without delay upon the powder in the vessel, so as to afford no time for their separation). Treat the paste and cake subsequently in the same way as already described.

Spread the syrupy tannin obtained by these two operations (which will generally suffice to effect the extraction of the whole of that principle from the gallnuts) on plates by means of a brush, and place the plates in a stove heated to 113° Fahr. The matter swells up considerably, and leaves the tannin in thin, light, and nearly colourless plates (like foil).

100 parts of gallnuts yield above 60 parts of tannin by this process.

The tannin produced by this method is not perfectly pure. M. Guibourt has found in it a little chlorophyle, volatile oil, gallic acid, and ellagic acid. Notwithstanding these admixtures, however, it may be considered sufficiently pure for therapeutical purposes. If you wish to have it pure you need simply put into a vessel equal parts of tannin, water, and washed ether, to shake the mixture, and to let it subsequently stand at rest, when it will separate into three layers, of which the lowest is pure tannin. This may then be dried in the way already described.

Tannin is a very powerful astringent, from which the most energetic effects may be expected. It is used in doses of from a few centigrammes to 6 or 8 grammes. Internally it is administered in the form of pills, externally in aqueous solution.

GALLNUT GARGARISM.

Take of Gallnuts, 4 to 8 grammes.
Boiling water, 50 grammes.

Infuse.

This gargarism is used to put a stop to salivation resulting from the administration of mercury.

DR. GIBERT'S INJECTION.

(*Tannic Alcohol—Compound Tincture of Gallnuts.*)

Take of Coarsely-pounded gallnuts, 4 parts.
Water, 16 parts.

Boil down to 18 parts; strain with expression, and add to the strained fluid—

Rectified alcohol, 9 parts.
Eau de Cologne, 1 part.

Filter.

The product, diluted with 6 to 10 times its own weight of water, is used as an injection in leucorrhœa and blenorrhœa.

GULLEN'S ANTIHEMORRHOIDAL POMATUM.

Take of Gallnuts, in powder, 1 part.
Hogslard, 8 parts.

Mix.

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2. JUICES CHARGED WITH TANNIN.

The materia medica mentions four inspissated juices which contain a large proportion of tannin. These are the juices of Acacia vera, the Acacia nostras, and Kino and Catechu. The two former are hardly ever used now. That of Acacia vera is the juice of the fruit of the tree of that name. Acacia nostras is the inspissated juice of the fruit of prunus spinosa.

CATECHU.

Catechu is an extract prepared by the decoction of the wood, and perhaps of the fruits, of the Acacia catechu of the East Indies.

Catechu is composed principally of

- Tannin,
- Extractive matter,
- Mucilage,
- Catechin,
- An insoluble residue containing extraneous matter, and sometimes also sand, which has been fraudulently introduced into the extract, in order to increase the weight of the latter.

The tannin of catechu has received the name of mimotannic acid. It has been carefully examined by Berzelius. It is readily soluble in water and in alcohol, but only very sparingly soluble in ether.

The aqueous solution of pure mimotannic acid is colourless, but it speedily acquires colour, first at the surface, and finally throughout the whole mass; upon evaporation a residue is left similar in every respect to catechu. The compounds which mimotannic acid forms with the acids are very soluble; alkalis fail to precipitate it from the solutions of such compounds.

The catechin, called also tanningenic or catechutic acid, is of no importance in a medical point of view. It is extracted by the action of boiling water upon catechu which has been extracted previously with cold water. It crystallizes in white silky needles, which, when moist, readily suffer alteration in the air. It dissolves in the alkalis; the solution is exceedingly liable to undergo decomposition. Exposure to the air at a high temperature transforms a solution of catechin in caustic potass in excess into a coloured liquid containing a black acid (japonic acid); this acid is almost absolutely insoluble in water.

Another acid product, which has received the name of rubinic acid, is obtained when a solution of catechin in an alkaline carbonate is left to spontaneous evaporation.

Catechu is used as a tonic in small doses (a few centigrammes), and as an astringent in larger doses. The taste is slightly saccharine, and by no means disagreeable.

SECTION I.—PREPARATIONS CONTAINING THE WHOLE SUBSTANCE OF THE CATECHU.

CATECHU POWDER.

Take of the best catechu, any quantity you may require.

Reduce to powder, without leaving a residue.

Sift the powder through a hair sieve.

CATECHU GLOBULES OR BERRIES.

Take of Catechu in powder, 1 part.
Pounded sugar, 4 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix to form a thick paste, and divide them into small pilular globules. As this operation takes much time, the mass should be kept meanwhile in a china or delf vessel to prevent its exsiccation.

The catechu berries are scented with various perfumes:—

The odour of ambergris, or of vanilla, is imparted to them by the admixture of a sufficiency of the alcoholic tincture of these substances.

A violet odour is given them by the admixture of 1-60th part of powder of Iris florentina.

A cinnamon scent is given them by the admixture of 1-20th part of cinnamon in powder; or a mucilage of gum tragacanth prepared with cinnamon-water may be used.

A rose odour is imparted to them by means of essence of roses, and the use of a mucilage prepared with rose-water.

BOLOGNA PASTILS OF CATECHU.

(*Pastiglie di Terra Catecu Aromatica.*)

Take of Extract of liquorice prepared by infusion,
Water, of each 100 grammes.

Dissolve in the water-bath, and add—

Powder of catechu, 30 grammes.
Gum arabic, 15 grammes.

Evaporate to the consistence of an extract, and incorporate with the mass—

Finely-pounded mastic,
" cascarilla,
" charcoal,
" iris florentina, of each 2 grammes.

Bring the mass to the proper consistence, remove it from the fire, and add—

Volatile oil of peppermint, 2 drops.
Tincture of ambergris,
" musk, of each 5 drops.

Run the mass out on an oiled marble slab, and spread it to the thickness of a sixpence by means of a glass or porcelain rolling-pin. When the mass is cold rub it with unsized paper, to remove every trace of oil from both sides. Moisten both sides slightly, and spread over them silver foil. Let it dry, and cut into very narrow slips; cut these latter finally into squares or very small lozenges.

The catechu pastils which come from Italy are enclosed in small deal boxes, containing each about 20 grammes of pastils, and covered with a large red seal.

This preparation has a very agreeable taste, and forms also an excellent sweetmeat.

LOZENGES OF CATECHU AND MAGNESIA.

Take of Catechu in powder, 1 part.
Calcined magnesia, 2 parts.
Pounded sugar, 15 parts.
Mucilage of gum tragacanth, prepared with cinnamon-water, a sufficiency.

Mix, and make into lozenges of 1 gramme each.

Each lozenge contains 5 centigrammes of catechu and 10 centigrammes of magnesia.

§ II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON CATECHU.

PTISAN OR POTION OF CATECHU.

Take of Coarsely-pounded catechu, 8 grammes.
Boiling water, 1,000 grammes.

Let the mixture infuse for two hours, and strain without expression.

Maceration would yield a product less abundantly charged with the active principle.

EXTRACT OF CATECHU.

Take of Coarsely-powdered catechu, 1 part.
Boiling water, 6 parts.

Let the mixture infuse for twenty-four hours, with occasional stirring. Strain with expression, filter, and evaporate the filtrate to the consistence of an extract.

I obtained from 100 parts of catechu 25 parts of dry extract. But the amount of the product varies greatly.

SYRUP OF CATECHU.

Take of Purified extract of catechu, 1 part.
Distilled water, 4 parts.
Simple syrup, 60 parts.

Dissolve the extract of catechu in the water, filter the solution, add the filtrate to the boiling syrup, and boil to 30°.

Every 30 grammes of the product contain 50 centigrammes of the extract of catechu.

Formerly this syrup was prepared with catechu of commerce; but, as this latter contains very variable proportions of soluble matter, it has been deemed the safer plan to substitute the extract for it.

CATECHU LOZENGES.

Take of Catechu in powder, 1 part.
Pounded sugar, 4 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of 60 centigrammes each.

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§ III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON CATECHU.

TINCTURE OF CATECHU.

Take of Catechu, 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the catechu macerate for fifteen days in the alcohol; filter.

CATECHU WINE.

Take of Tincture of catechu, 1 part.
Red wine, 12 parts.

Mix, let the mixture stand a few days, and filter.

Thirty grammes of this preparation correspond to about fifty centigrammes of catechu.

KINO.

Kino, which has been very improperly called gum kino, is usually attributed to the Uncaria gambix of East India; but the name has been indiscriminately applied also to the juices of several very different plants, so that there exists still great confusion and uncertainty on the true origin of this substance.

Kino consists principally of tannin. Berzelius has isolated the latter in a pure state. The pure tannin of kino is remarkable for the facility with which it forms coloured extractive; its solutions, when left in free contact with the air, acquire speedily colour, from the formation of an insoluble apothema.

The kino of commerce is imperfectly soluble in water. It is a good tonic and astringent, and has been given with success in certain cases of diarrhœa and leucorrhœa; but it is less energetic in its action than many other known astringents.

It is mostly given in the form of powder, but sometimes also in that of a syrup, or in alcoholic tincture.

F. Humphreys, Lambeth, for certain improvements in marine steam-engines, which improvements are also applicable to steam-engines for other purposes. Patent dated March 28th, 1835; expired March 28th, 1849.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

EXAMINATION OF THE FATTY OILS OF WHITE AND BLACK MUSTARD-SEEDS.

By Mr. STEPHEN DARBY.*

The seeds of Sinapis alba and Sinapis nigra contain a not inconsiderable quantity of a fixed inodorous oil; of the chemical nature of this oil hardly anything has been known hitherto beyond the fact that the fatty acids which it contains are combined in it with oxide of glycerule.

J. Fontanelle† obtained from mustard-seeds (probably Sinapis nigra), by the action of a good press, one fifth part of their own weight of a mild amber-coloured oil, of 0.9202 sp. gr., soluble in 4 parts of ether and 1,000 parts alcohol of 0.833 sp. gr., and congealing only below 32° F.

According to Henry and Garot, this oil contains a solid fat which crystallizes in white nacreous spangles, fuses at 248° Fahrenheit, and is not saponified by the action of alkalis.

The more recent investigations on the fatty acids, and more particularly on that section of them of which the constitution is expressed by the formula:—

$$(C H)n + O_4,$$

have supplied us with nearly all the links wanted to complete the series of these interesting bodies. The examination of the oleïc acid of the siccative oils by Gottlieb, that of the ricinic and elaiodic acids by Saalmüller, that of moringic acid by Walter, have introduced to our notice a series of fatty acids differing in composition from those of the

$$(C H)n + O_4$$

series, inasmuch as they contain a less number of atoms of hydrogen than of carbon. It would appear that this new series of fatty acids is equally numerous with that of the $(C Hn) + O_4$ type.

The present paper gives the results of an investigation of the fixed oil of Sinapis alba and nigra, which I have made at the request and under the superintendence of Professor Will. Although the results at which I have arrived leave still several questions open with respect to the fluid fatty acid contained in the fixed oil of mustard, yet I think they fully demonstrate the existence in this oil of a new acid belonging to the same series with the oleïc acid of the non-siccative oils.

FIXED OIL OF WHITE MUSTARD.

The oil upon which I operated was obtained from the seeds of Eruca officinalis; the seeds were crushed and gently heated previous to being subjected to the action of the press. The oil is fluid; it has a light amber colour, and mild taste; it is inodorous. It does not congeal even in frosty weather, but turns simply thick and turbid. When the oil is heated in a test-tube, acrolein is disengaged, which is an evident proof that the fatty acids contained in the oil are combined in it with oxide of glyceryle.

The fat was mixed with a concentrated solution of caustic soda, and the mixture heated until complete saponification ensued: the soap produced was perfectly soluble in water. The results of this operation disprove Fontanelle's assertion that the oil contains a solid, non-saponifiable fat.

The aqueous solution of the soap was mixed with common salt, and the soap, which separated upon the addition of the latter reagent, was then again dissolved in water, and once more separated by means of common salt; after a third repetition of the same process the soap was found to be perfectly white and free from admixture of glycerin.

The purified soap was now decomposed by

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* Communicated by the author. This paper was published in German in Liebig's "Annalen," vol. lxix., Part I.

† Berzelius's "Jahresbericht," vol. vi., page 263.

means of dilute hydrochloric acid; the product of the process was a fluid mixture of fatty acids. This mixture was thoroughly washed, first with acidified hot water, finally with pure hot water; the fatty acids composing it were then converted into basic lead compounds, by digestion with finely-levigated oxide of lead in the water-bath.

The plaster obtained by this proceeding was digested with ether as long as this menstruum continued to dissolve part of it. The residue was then treated with hydrochloric acid and alcohol. The liquid was filtered off from the chloride of lead produced, and the alcohol distilled off the filtrate; the residue (the new acid) was freed from the hydrochloric acid adhering to it by washing with warm water. It was then repeatedly recrystallized from alcohol until it appeared perfectly white. In this state it fused at 93.2 Fahr. Six successive recrystallizations left the fusion point unaltered (93.2 Fahr.). The acid was now melted in the water-bath, and then left to cool. The portion of it which solidified first was separated by decantation from that which remained still fluid. No difference, however, was discoverable between the two portions; they both fused at 93.2 Fahr., and concreted again at 91.4 Fahr.

From alcoholic solution the new acid crystallized in brilliant needles. The thoroughly dried acid gave upon combustion with oxide of copper the following results :—

I. 0.293 grm. gave 0.836 of carbonic acid and 0.3335 of water,

II. 0.143 grm. gave 0.4065 of carbonic acid and 0.167 of water,

III. 0.382 grm. gave 1.083 of carbonic acid and 0.427 of water,

which corresponds in 100 parts to :—

	I.	II.	III.
Carbon.....	77.8	77.5	77.3
Hydrogen	12.4	12.8	12.4
Oxygen	9.8	9.7	10.3
	100.0	100.0	100.0

Taking the atomic weight inferred from the results of the analyses of the silver, lead, and baryta salts of the acid as the basis of our calculation, we find that the composition of the solid fatty acid of the oil of white mustard may be represented by the formula :—

$C_{44} H_{42} O_4 = C_{44} H_{41} O_3, HO.$

This formula demands in 100 parts :—

		Calculated.
44 equivalents of carbon ...	264	78.1
42 " hydrogen	42	12.4
4 " oxygen ..	32	9.5
	338	100.0

A fatty acid of this composition, with the fusion point at 93°.2 F., was not previously known. As I found it first in the seeds of Eruca officinalis, I propose to call it *erucic acid*. It bears most analogy to the *behenic acid* which was examined by Völker.*

According to Strecker's corrected formula for behenic acid, we have :—

	Fusion Point.
Behenic acid $= C_{44} H_{44} O_4$	168°.8 F.
Erucic acid $= C_{44} H_{42} O_4$	93.2

ERUCATE OF SILVER.

$C_{44} H_{41} O_3, AgO.$

This salt was prepared by precipitating with nitrate of silver an alcoholic solution of erucic acid supersaturated with ammonia. The caseous precipitate obtained, which was found to acquire speedily a dark colour, was thoroughly washed, pressed between folds of blotting paper, and dried in vacuo over sulphuric acid.

I. 0.420 grm. left upon ignition 0.110 grm. of metallic silver.

II. 0.945 grm. left upon ignition 0.245 grm. of metallic silver.

* Liebig's "Annalen," vol. lxiv., page 362.

This corresponds to :—

	Calculated.		Found. I.	Found. II.
1 eq. of erucic acid	329	74.0	—	—
1 eq. of oxide of silver..	116	26.0	26.0	25.7
$C_{44} H_{41} O_3, AgO$ =	445	100.0		

ERUCATE OF LEAD.

$C_{44} H_{41} O_3, PbO.$

To prepare this salt a solution of erucic acid in absolute alcohol was mixed with dry carbonate of soda, and the mixture heated until a neutral soda salt had formed. The clear solution was now mixed with an alcoholic solution of sugar of lead: the result was the subsidence of a precipitate of a pure white colour. This precipitate was carefully washed with alcohol, pressed between folds of blotting paper, and dried in vacuo. The perfectly dry salt was then analyzed. The results were as follows :—

0.283 grm. gave 0.619 of carbonic acid and 0.200 of water.

0.301 grm. gave 0.112 of sulphate of lead.

0.377 " 0.141 " "

This corresponds to :—

	Calculated.		Found. I.	Found. II.
44 eq. of carbon	264	59.9	59.7	—
41 " hydrogen ..	41	9.3	9.3	—
3 " oxygen	24	—	—	—
1 " oxide of lead	112	25.26	25.28	25.5
$C_{44} H_{41} O_3, PbO$ =	441			

ERUCATE OF BARYTA.

$C_{44} H_{41} O_3, BaO.$

This salt was prepared in the same way as the erucate of lead, with this essential difference of course, that an alcoholic solution of acetate of baryta was used instead of one of sugar of lead. A white flocculent precipitate of erucate of baryta was obtained. This was washed, pressed between folds of blotting paper, dried in vacuo, and finally analyzed. The results were as follows :—

0.205 grm. gave 0.484 of carbonic acid and 0.192 of water.

0.597 grm. gave 0.172 of sulphate of baryta.

This corresponds to :—

		Calculated.	Found.
44 eq. of carbon.....	264	65.0	64.36
41 " hydrogen....	41	10.1	10.40
3 " oxygen	24	—	—
1 " baryta.....	76.6	18.8	18.9
$C_{44} H_{41} O_3, BaO$ =	405.6		

With a view to ascertain whether the seeds of white mustard contain invariably the same solid fatty acid, I procured some fixed oil of mustard derived from another source. I obtained an acid with the same fusing point (93.2 F.), and perfectly identical in properties with the erucic acid.

Having thus fixed the composition of the solid fatty acid of the oil of white mustard, I proceeded to examine the ethereal solution obtained at an early stage of the process upon the digestion of the mixed lead salts (with the fatty acids) with ether. The ether was distilled off, and the residue mixed with hydrochloric acid and alcohol; the fluid was then filtered off the precipitated chloride of lead; the alcoholic filtrate was evaporated, and the baryta salt of the residuary crude oleic acid formed after Gottlieb's method.* The analysis of this baryta salt gave figures which, in the proportion of baryta, did not agree with the composition of oleate of baryta.†

* Liebig's "Annalen," vol. lvii., page 41.

† I. 0.248 grm. gave 0.219 HO and 0.551 CO_2; 0.660 grm. gave 0.200 BaO, SO_3. II. 0.331 grm. gave 0.291 HO and 0.743 CO_2; 1.019 grm. gave 0.311 BaO, SO_3. III. 0.551 grm. gave 0.166 BaO, SO_3. IV. 0.510 grm. gave 1.159 BaO, SO_3. V. 0.386 grm. gave 0.119 BaO, SO_3.

I obtained :—

	I.	II.	III.	IV.	V.
Carbon....	60.57	61.2	—	—	—
Hydrogen .	9.81	9.76	—	—	—
Oxygen ...	—	—	—	—	—
Baryta....	19.9	20.0	20.0	20.4	20.2

The amount of baryta remained the same, even after six or seven successive recrystallizations of the salt.

These figures correspond nearly to the formula :—

$C_{38} H_{36} O_4, BaO.$

This formula demands :—

38 eqs. of carbon.....	228	61.2
36 " hydrogen ..	36	9.6
4 " oxygen	32	8.8
1 " baryta.....	76.6	20.4
$C_{38} H_{36} O_4, BaO$ =	372.6	100.0

The oleate of baryta,

$C_{36} H_{33} O_3, BaO,$

demands—

Carbon	61.79
Hydrogen	9.4
Baryta	21.9

We have accordingly here a difference of near two per cent. in the respective amounts of baryta in the two salts, which proves either the existence of a new acid differing from the oleic acid of the non-siccative oils, or an admixture of another acid of higher atomic weight, and of which the lead salt is equally soluble in ether. The decision of this question I must leave to future experiments.

FIXED OIL OF THE SEEDS OF SINAPIS NIGRA.

I treated the fixed oil of the seeds of black mustard in the same way in which I had treated that of the eruca-seeds. I found that the fixed oil of the sinapis nigra-seeds contains three fatty acids, viz., sebacic acid, erucic acid, and a fluid fatty acid, which seems to be identical with that just now treated of, inasmuch as the baryta salt prepared with it is, even after repeated recrystallization, found to contain only 20.4 per cent. of baryta.

The lead salt, insoluble in ether, was found to contain two solid fatty acids, viz., sebacic acid and erucic acid, which were separated from one another by crystallization.

The portion which crystallized out first was repeatedly recrystallized. It fused at a little above 158° F., and solidified again at 158° F.

The analysis of the baryta salt prepared with this acid gave the following results :—

I. 0.166 grm. of the baryta salt gave 0.3695 of carbonic acid and 0.152 of water.

II. 0.220 grm. gave 0.492 of carbonic acid and 0.210 of water; 0.080 grm. gave 0.028 of sulphate of baryta.

This corresponds to :—

$C_{68} H_{66} O_5, 2BaO.$

		Calculated.	Found. I.	Found. II.
68 eq. carbon ...	408	61.08	60.68	60.95
66 " hydrogen	66	9.90	10.10	10.50
5 " oxygen ..	40	—	—	—
2 " baryta ...	153.2	22.96	22.99	—

$C_{68} H_{66} O_5 2BaO = 667.2$

The acid is accordingly sebacic acid.

The acid which remained still in the alcoholic solution, after the crystallization of the sebacic acid, crystallized equally soon after. It was repeatedly recrystallized. It fused at 93.2 F., and possessed all the properties of erucic acid. A baryta salt prepared with it was, upon analysis, found to contain 19.0 per cent. of baryta. Calculation based upon the formula :—

$C_{44} H_{41} O_3, BaO,$

demands 18.8 per cent. of that earth.

P. A. de Chapeaurouge, London, for a machine, engine, or apparatus for producing motive power, which he denominates a self-acting motive power, and is called in France by the inventor "volant moteur perpétuel." Patent dated March 31st, 1835; expired March 31st, 1849.

ON THE EXISTENCE AND EFFECTS OF ALLOTROPISM IN THE CONSTITUENT ELEMENTS OF LIVING BEINGS.

By JOHN WILLIAM DRAPER, M.D.,
*Professor of Chemistry in the University of New York.**

It has been completely established for the majority of elementary substances that there are several forms under which each may occur, forms which differ entirely both in their physical and chemical relations.

Thus, in the case of carbon many such forms are known. To three of them M. Berzelius has directed attention: — 1st, ordinary charcoal; 2d, plumbago; 3d, diamond. They are three distinct modifications of the same element. They differ in specific gravity, in specific heat, and in conducting power, both for electricity and caloric. In their relations to light the first perfectly absorbs it and is black; the second reflects it like a metal; the third is transparent, like glass. When crystallized, plumbago and diamond do not belong to the same system; their chemical relations are also strikingly different. Charcoal takes fire with facility, and some varieties of it are even spontaneously combustible in the air; but crucibles and furnaces are made of plumbago because of its incombustibility; and the diamond with difficulty is set on fire in pure oxygen gas.

It seems immaterial to what class elementary bodies belong, whether electro-negative or positive; they present analogous results. Silicon, sulphur, selenium, phosphorus, titanium, chromium, uranium, tin, iridium, osmium, copper, nickel, cobalt, iron, oxygen, chlorine, are cases in point; and the instances which appear as exceptions are rapidly diminishing in number.

As is well known, to these singular modifications M. Berzelius gave the designation of allotropic forms, and the whole phenomenon passes conveniently under the designation of allotropism. He shows that the peculiarity assumed is often of such a persistent nature that it is not lost, even though the substance affected should go into combination with others. Thus there are two forms of silicon; one combustible, and the other remarkably incombustible. Each, by uniting with oxygen, gives rise to a silicic acid; the acid in one case being soluble in water and in hydrochloric acid, and in the other the reverse. And in like manner metallic arsenic, which exhibits the same duality of condition, gives rise to two different arsenious acids. Of phosphorus there are at least two modifications; and accordingly we have two compounds of that body with hydrogen, one of which is spontaneously inflammable, and the other not; and at least two oxygen acids, the monobasic and tribasic, in which the essential difference rests in the state of the phosphorus they contain.

It is to be remarked that, so far as observation extends, the most common cause of producing these singular differences is the action of that class of agents which we term imponderable substances. In very many cases change of temperature brings about allotropic change; in others it is the agency of light, as in chlorine and phosphorus; and again, in others, association with foreign bodies, which apparently establish new voltaic relations. Heat, light, and electricity seem to be the general modifying agents.

M. Berzelius, following the suggestion of M. Frankenheim, proposes a nomenclature for pointing out the peculiar form referred to in any special case. It depends on the use of Greek letters. Thus we have the three forms of carbon just alluded to designated on these principles by Cα, Cβ, Cγ. But in a paper which I published in "The Phil. Mag.," on the allotropism of chlorine (Nov., 1845, p. 327), it is remarked that we may often with greater convenience use the simple expressions "active" and "passive." Thus active chlorine is that which will decompose water in the dark, passive chlorine failing to do so. In this paper the same expressions will be employed.

Hitherto allotropism has only been considered as affecting inorganic states of matter, but its influence can be plainly traced in the far more interesting case of organic beings; and, when placed in a proper point of view, yields a remarkable explanation of some of the most obscure but important facts in physiology and pathology. These explanations I propose now to point out.

In "The Philosophical Magazine" (March, 1846, p. 178) there is a paper by me explanatory of the cause of the circulation of the blood in the capillary vessels. It is merely an abridgment of a lecture which, for eight years past, has been delivered in this university. The doctrine there set forth has been generally received in America, and introduced into some of the standard works on physiology published in England. The principle on which it essentially depends, and which has been abundantly confirmed by direct experiment, is briefly this—that if there be two fluids occupying a capillary tube, or a porous structure of any kind, under the condition that one of them has a stronger chemical affinity for the substance of that tube or structure than the other, a movement of the liquids will at once ensue, that which has the stronger affinity driving the other before it. On this principle a clear account of the systemic circulation of animals may be given; for the arterial blood, an oxidizing liquid, having a stronger affinity for the soft tissues with which it is in contact than the venous blood, the affinities of which have been satisfied and therefore no longer exist, necessarily exerts such a pressure that motion must ensue, the arterial blood forcing the venous before it.

An application of the same principles shows that in the pulmonary circulation the motions must necessarily be in the opposite direction, or from the venous to the arterial side, as is actually the case. It also explains clearly the conditions of the portal circulation, in which the direct action of the heart could hardly be expected to be felt. With the generality which ought to belong to a true theory, it meets all the cases which occur in the lower orders of animal life, such as the greater circulation in fishes, in which there is no systemic heart; the movements which take place in the vascular system of insects; and even the extreme case of the rise and descent of sap in plants.

In this doctrine everything depends on the relationship between the nutritive fluid, or blood, and the solid parts with which it is brought in contact; and whatever changes that relationship must impress a corresponding change on the circulation itself.

From experiments which I made some time ago, I have been led to suppose that the arterialization of the blood, as it takes place on the cell-walls of the lungs, bears a strong analogy to the oxidation of white indigo. The loose hold which the colouring matter of the blood retains on the oxygen, coupled but not combined with it, is not unlike what is witnessed in other nitrogenized colouring matters, such as indigo, which oxidizes and deoxidizes with the utmost facility. Charged with the oxygen it has thus obtained, the arterial blood passes to all parts of the system; and now arises that striking, but all-important, physiological fact, that it does not attack indiscriminately all those parts of the soft solids which it first encounters, but, proceeding in a measured way, exerts its action on such particles alone as have become effete, and, accomplishing the great process of interstitial death, resolves those particles into other forms, so that they can be eliminated from the system by the lungs, the kidneys, and the skin.

Now, why is it that things proceed in this way? What is it that regulates this interstitial death? Why is one atom preserved and another surrendered?

It is upon these obscure points that the recent discoveries in allotropism shed a flood of light.

The three leading neutral nitrogenized bodies, fibrine, albumen, and caseine, are characterized by exhibiting allotropism in a most remarkable degree, and that in a double sense. 1st. Though so different from one another in their physical and chemical relations, it is admitted on all hands that they are mutually convertible; the albumen of the egg, during incubation, gives rise to fibrine and other allied bodies; from caseine, in the milk with which the young mammalia are nourished, the albuminous and fibrinous constituents of their systems arise; the nurse fed on fibrine and albumen secretes caseine from the mammary gland. Indeed, there is no more reason to regard these three bodies as essentially distinct substances, than there is to apply the same conclusion to charcoal, plumbago, and diamond. Between the two cases there is the most complete analogy; and if charcoal, plumbago, and diamond are merely allotropic forms of one substance, the same holds good for fibrine, albumen, and caseine. But 2d, each of these three compounds betrays a disposition under trivial causes to assume new forms; as with silicic acid so with fibrine, there are two varieties, one soluble in water, the other not. A difference of a few degrees of heat turns transparent albumen into the porcellanous variety, and analogous observations might be made respecting caseine.

It may, therefore, be asserted that these proteine bodies exhibit a propensity to allotropism in a far more remarkable manner than any other substances known; not only passing indiscriminately into one another, but also exhibiting special variations under the influence of the most trivial causes.

And now we may recal the fact, that, of the agents which in the inorganic kingdom bring about these changes, the imponderable principles are pre-eminent. I transfer this observation to the case of organized beings, and infer that the nervous system has the power of throwing organized atoms into the active or passive state; that this is the fundamental fact on which all the laws of interstitial death depend; and that upon this principle—its existing allotropic condition—an organized molecule either submits to the oxidizing influence of arterial blood, or successfully resists that action.

But it has been stated that there are certain pathological conditions which, upon these views, meet with a clear explanation,—conditions which, though long and laboriously studied by physicians, remain involved in contradictions and obscurity. The conditions to which I refer are those known as inflammation and congestion.

It is agreed among chemists that during the prevalence of these conditions the urine assumes a peculiar constitution. In inflammatory actions the relative quantity of urea and sulphuric acid is much above the normal standard, whilst in congestive cases the reverse holds good, and the urea and sulphuric acid are below the standard. What is the interpretation of these remarkable facts? We shall find they are very significant.

The quantity of urea and sulphuric acid in the urine undoubtedly expresses the quantity of proteine matter that has undergone oxidation in the system. In all cases where that quantity is above the normal standard, the destruction of proteine matter has been correspondingly accelerated; and where it is deficient the destruction has been reduced. The result of inflammations corresponds to the first of these cases, and of congestions to the second.

Recalling now what has been said respecting the cause of the capillary circulation, we see how all these apparently disconnected facts group themselves together in the attitude of dependent effects. In inflammation there has been that allotropic change in the soft solids involved, that they have assumed a disposition for rapid oxidation—they are active. Their relations with arterial blood have become highly exalted; and the blood flows, on the principles I have set forth, to the affected part with energy. Redness of that part and a higher temperature are the result. Oxidation goes on with promptitude, and urea

* Communicated by the author to "The Phil. Mag."

and sulphuric acid begin to accumulate in the urine.

But in congestive cases it is the reverse; the parts affected are thrown into a more passive state. Oxidation goes on in a reluctant way, the amount of tissue metamorphosed diminishes, the urea and sulphuric acid diminish in the urine; and, on the principles which I have endeavoured to explain respecting the capillary circulation, we perceive that an immediate action must be exerted on the flow of the blood, the passive condition of the tissues and diminished capacity for oxidation restrain the flow from the arteries, and, there being now less pressure on the contents of the veins, engorgement of those vessels is the result, and this condition of things is what a physician designates as congestion.

In this manner, if we admit the existence of allotropism in organic atoms, we can give a very clear explanation of the condition of the circulation in the pathological states of inflammation and congestion, and also of the peculiarities which in those states belong to the constitution of the urine.

THE PREVENTION OF ACCIDENTS BY POISONING.*

By Mr. THOMAS HARVEY, of Leeds.

[*Communicated by Mr. Deane, of Clapham-common.*]

I take the liberty of suggesting that a means of preventing the accidental substitution of dangerous medicines in dispensing more simple, and perhaps more effectual, than any that has yet been proposed would be to cap the bottles containing such articles as strychnia, veratria, morphia, and its salts, pulv. opii, &c. &c., with vulcanized indiarubber caps; or if these were not at hand to tie over the bottles with tinfoil, plain or coloured, or with bronze paper, or even leather.

The macintosh elastic cap would possess great advantage both in appearance and in the facility with which it might be removed and replaced. I need scarcely point out that this plan offers the least possible impediment to quickness and convenience in dispensing, while it offers a security almost complete againt the use of one of these articles in mistake for any other not included in the list of virulent poisons.

[NOTE BY MR. DEANE.]

In addition to the above I may mention my practice with certain articles, and I think you will at once see the value of the proposed method, which, however, is not new, as you had a letter on the subject some time ago. There are few shops where nearly every imaginable want in the medical department may be obtained on application, but there are a great many where a few stray out-of-the-way things are always to be met with in variable quantities; some may keep an ounce or two, or perhaps more, of both veratrine and jalapine, and those articles probably in well-labelled bottles, but others of our brethren may only keep a drachm or two, and those in half-ounce or one-ounce bottles, corked, and with a written label. Now, as both of these substances are really very similar in appearance, any one in a moment of abstraction may take the one for the other, and the result might be most disastrous. The same may be said of the two prussic acids, Scheele's and the P.L.; both may be kept with distinctive labels, and perhaps, as an additional precaution, in different kinds or sized bottles, yet this may not be sufficient in shops where the articles are not required for dispensing. Most of these small articles, if I may so term them, are kept aloof from the general visible shop stock, on account of the unsightly aspect they would present to the customers; and so being generally out of sight, and partially out of mind, require a greater effort to recognise their identity than those who are in the daily, and perhaps hourly, habit of dispensing them may suppose. Therefore, for a long time past, to prevent the possibility of accident from such causes, I have kept sundry dangerous articles not very frequently in use, but which are more conveniently kept on the same shelf with others having a similar appearance, tied over with a piece of leather. Thus the two prussic acids are together: Scheele's is tied over, not being frequently required, while the other is left free for the opposite reason. Veratrine and jalapine are near each other; the veratrine is tied over. Of larger articles, pulv. lyttæ and pulv. cubebæ are on the same shelf, and the action of light has brought the bottles to present a similar aspect. The former is always tied over, and not being in frequent use is not attended by any inconvenience. Arsenic is always tied over, wherever kept, for being a white powder it might be misplaced, and if not tied over lead to dangerous accidents.

The practice is applicable to a variety of articles, varying with the circumstances and requirements of the druggists in different parts of the country. I think, therefore, a few words from you on the value of the recommendation would have great weight, and benefit both the druggist and the community.

* From "The Pharmaceutical Journal."

ON THE COMPOSITION OF STEARIC ACID.

By MM. LAURENT and GERHARDT.

MM. Laurent and Gerhardt communicated to the Paris Academy of Sciences (sitting of March 26th) the results of a series of analyses of different samples of stearine derived from various sources. The differences between the respective amounts of carbon found in the several samples analyzed did not exceed 0.001 to 0.002; those between the respective proportions of hydrogen did not amount to more than 0.001.

The results of the analyses proved that the composition of stearic acid corresponds exactly with that of margaric acid:—

$$C_{17} H_{34} O_2.$$

M. Chevreul stated some time since that pure stearic acid, when distilled, passes over unaltered, like the other volatile acids of the same class (formic, acetic, butyric, &c., acids).

The results of MM. Laurent and Gerhardt's researches on the same subject have fully confirmed the correctness of M. Chevreul's statement.

REVIEWS.

MULDER'S CHEMISTRY OF VEGETABLE AND ANIMAL PHYSIOLOGY. (PART IV.)*

This part of M. Mulder's great work on "Vegetable and Animal Physiology" forms a distinct and separate treatise on the food and nutrition of plants.

In this part M. Mulder addresses himself to the consideration of the important questions of the chemistry of vegetable food—its nature; the form and manner in which it enters the plant; the organs which receive, transmit, and modify it; the changes that are induced by the modifications which it undergoes in these organs; the influence of habitual or accidental circumstances over these changes; the substances elaborated from the food in the various parts of the plant; the purposes which these substances subserve in the economy of vegetable life, &c. &c.

These questions are treated by M. Mulder with his usual acumen and that honesty of purpose which forms one of the most prominent features of this distinguished chemist, and readily reconciles us to certain foibles and defects which might otherwise tend to detract from the scientific value of his conclusions and opinions. Not that we mean to subscribe implicitly to every statement and inference which M. Mulder puts forth in his treatise—there are many points on which we differ from that gentleman's opinions, and we cannot help confessing that, almost in every instance where he chooses to attack and controvert Liebig's views, the victory seems to us to remain with the latter.

This part of the work addresses itself more particularly to the botanist, the student of vegetable physiology, the practical gardener and farmer. To all and either of these classes the contents will prove most useful and instructive, presenting many entirely new views and ingenious theories on the nutrition of plants.

The notes of Professor Johnston form a most valuable appendage to the work.

As specimens of the manner in which the author has treated the subject of his work we select the chapter on the inorganic food of plants, and that on the oxidizing influence of the atmosphere upon the substances produced by plants:—

"THE INORGANIC FOOD OF PLANTS.

"Among the nutritious substances that are indispensable to plants, the inorganic constituents of the soil have an equal right to be reckoned as the organic constituents, including carbonic acid, water, and ammonia.

"These organic substances are derived, not from the rain-water, which contains so little solid matter, and which is especially deficient in that which exists in plants, but from the decayed rocks, from which the powdery soil has been formed, and from which they are dissolved out by the rain-water. Some of these are found in ordinary river-water; more, however, in water which has passed through strata of the earth, and which is known by the name of spring-water. Pliny of old has justly remarked, 'tales sunt aquae, qualis terra per quam fluunt.'

"This water, which penetrates all decayed rocks, and, therefore, all soils, in manifold directions, is supplied to plants through their roots.

"The depth, however, at which this water is in a state of equilibrium is generally too great to admit of being reached in mass by the roots of herbaceous plants. The level of the water in the earth is in many places situated very deep, most frequently at least some feet below the surface. These plants, therefore, would at first view seem to live chiefly by means of the rain-water with which the upper layers of the earth are moistened.

"If this were the case, the vegetable kingdom would be in an unhappy condition, indeed, for the rain-water, falling upon the surface of the earth, enters there, washes out the upper layers, and, sinking deeper, carries along with it a large portion of the soluble salts. If, therefore, no other cause were in operation to counteract this one, short-rooted plants could not obtain the inorganic constituents which are necessary to their existence.

"Nature has provided for this in the following manner:—Soils always contain at a certain depth collections of spring-water. This water holds in solution a variety of salts which are necessary to plants, and among them are also those salts which have been washed out by the rain-water from the upper layers.

"In dry weather the surface of the soil gives off by evaporation nearly pure water. By capillary action the dried upper layers are again supplied by those below with water containing various salts. From this weak solution pure water is again separated by evaporation, and is again replaced by water containing salts. By this repeated process the salts of the water that was raised by capillary attraction remain behind in the upper layers of the soil, and are abundantly supplied to the roots, even though the water under ground may hold only few salts in solution.

"It is in this manner—by capillary attraction

* "The Chemistry of Vegetable and Animal Physiology. By Dr. G. J. Mulder, Professor of Chemistry at the University of Utrecht. Translated from the Dutch by Dr. P. F. H. Fromberg. With an Introduction and Notes by James F. W. Johnston, F.R.SS.L. and E. Part IV."

and evaporation—that the salts which had been washed out by the rain from the upper layers of the soil are again restored.

"Plants obtain in this way chlorides, sulphates, and carbonates of lime, magnesia, potash, and soda, and also silicate of potash, but these are not the whole of the salts that are found in plants. In rye, and a great many other plants, there is a large quantity of phosphates. These are not found in the water, and rye cannot, therefore, grow luxuriantly unless it finds these indispensable constituents in the soil. Phosphate of lime is actually present in many fertile clay soils, and, if it be wanting, it is effectually added to the soil as a true manure. It needs no argument to prove that the fertility of soils in which plants are cultivated that contain much phosphates, without which they cannot live, depends on the proportion of phosphates contained in the soil.*

"The salts which must be supplied to the roots are not merely those which constitute the inorganic constituents of plants. Almost all plants contain bases combined with neutral organic substances, for gum and mucilage always occur in combination with lime. Besides, there are a great many plants with organic acids, which require bases to exist in those plants. Acids are seldom found in a free state there, unless we count as such the half of the oxalic or tartaric acid, which are only combined with water, and are found as such in the salt of sorrel (oxalate of potash with oxalate of water), and in cream of tartar (tartrate of potash with tartrate of water). Tannic acid, however, and a few others, are present in a free state, probably because they could find no bases to combine with, having been formed in places where none existed.

"The potash of these two salts—salts of sorrel and cream of tartar—has plainly been extracted from the soil, and the same remark applies to all the organic salts of plants containing inorganic bases.

"These bases—potash, soda, lime, and magnesia—are very differently distributed among the different parts of the same plant, and their presence is evidently connected with the functions of the parts in which they are found in greater or less proportion.

"We may ask, in what state are these bases conveyed into plants,—as organic salts,—ulmates, humates, geates, apocrenates, and crenates—or as sulphates, carbonates, and chlorides?

"This question may be answered as follows:—In the first place, nearly all plants contain organic substances in which sulphur is present, viz., albumen and gluten. This sulphur can only have been derived from the decomposition of sulphuric acid, and the latter, again, from sulphates. Sulphates, therefore, can be decomposed and yield sulphur, and the base of the sulphate, being set at liberty, may enter into combination with some organic acid within the plant; for instance, aconitic or quinic acid, &c. Now, as these substances containing sulphur—albumen and gluten—are universally present in plants, the decomposition of the sulphates and liberation of their bases is universal also.

"But there is still another source of free bases. Some of the protein compounds in plants contain free phosphorus. This indicates the decomposition of phosphoric acid separated from phosphates, and consequently the liberation of their bases, which are thus left to enter into combination with organic bases.

"There is no reason for assuming a decomposition of chloride in plants.† It is, however, worthy of remark, that in sea and coast plants, and some animal productions in seas and on shores, iodine does occasionally exist in the state of an organic elementary substance. In sponge, for instance, iodine is found combined with carbon, hydrogen, nitrogen, and oxygen, in the same way as sulphur is in albumen.

"But we may assume as certain that carbonates are decomposed in plants. When, for instance, oxalic acid exists ready formed, it will decompose any carbonate that is present, expelling the carbonic acid, and combining with its base. But it appears also, from the experiments of Draper, that carbonates are directly decomposed by plants. Whenever, therefore, a free acid is produced, the carbonates that are present must lose their acid; and, on the other hand, whenever a carbonate is decomposed by the plant through the action of light, an alkali is set free, and there is an opportunity for the production of an alkaline salt containing an organic acid.

"If we, moreover, consider that the roots of plants absorb silicate of potash or soda, and that the acid of these plants is in several places separated, and potash or soda set free; further, that humates, ulmates, geates, apocrenates, and crenates of potash, soda, magnesia, lime, and iron, enter into plants, and that immediately after they have done so the organic acids of these salts are decomposed; we perceive that there are abundant sources for the liberation of inorganic bases, which may combine within the plants with vegetable acids as they are formed, and also with neutral vegetable substances, such as gum, mucilage, dextrin, pectose, cellulose, incrusting matters, cuticular matter, &c.

"As a result, therefore, of the well-known decomposition of sulphates, phosphates, carbonates, silicates, ulmates, humates, geates, apocrenates, and crenates, in plants, inorganic bases are liberated, which may combine with organic acids that may be formed, and produce salts of potash, soda, lime, magnesia, oxide of iron, and oxide of manganese. Some of these bases may occasionally replace each other in whole or in part. Thus soda may be replaced by potash, ammonia by soda, or *vice versâ*, and magnesia by lime. The chemical properties of these bases are very analogous, and, therefore, when they exist in a soil there are plants—not all plants, however—which take the one instead of the other.

"It is well known that there are limits to this exchange of bases. Plants on the coast which require soda do not grow in soils containing potash but no soda. And, although we may be able by cultivation to accustom plants to a certain difference in this respect, it is, nevertheless, most improbable that a plant, after having taken up bases that are quite different from those which are originally peculiar to it, should preserve its original chemical character. The seed of the tobacco plant from Havannah, when transplanted to Java, produces tobacco approaching to that from the Havannah; but even the first seed sown in Java yields a produce which differs to some extent from the Havannah variety, and, after the seed has been collected and again sown several times, the Havannah tobacco degenerates at last into Java tobacco. The only reason of this must be the difference of the bases existing in the several soils of Havannah and Java.

"It has always been thought that the difference between cultivated and wild plants was to be ascribed to an excess of food which is supplied to the former. There is no doubt that this is the cause to a certain extent; but we ought to regard as an additional cause the difference in the inorganic constituents of the soil.

"Although it may be true, therefore, that some bases replace each other in plants, this does not at all imply as a certainty that the plants thereafter retain their character unchanged, and exhibit the same properties and the same organic constituents. Experience shows that the reverse is the case, for there is a considerable difference between the bases of plants of different qualities, both in regard to their use as food and in pharmacy.*

"No sufficient distinction has yet been drawn as to which bases exist in the solid, and which in the liquid, parts of the plant. And yet such a distinction would be of great importance. The expression in the plant is crude and vague. The solid parts of a plant are very different in nature and properties; and hence, again, the expression, in the solid parts of the plant, is unscientific. In this respect science has hitherto done almost nothing.

"It would, indeed, be a marvellous coincidence of innumerable different circumstances if there were really such a relation between the bases which are found in the same species of plant, cultivated on different soils, that the quantity of oxygen in the bases was always constant. Liebig thinks that this is actually the case, but it requires no proof that this can only happen by accident. We might suppose from general principles that the quantities of oxygen are about the same in the same plants; but it follows from the analyses that have been made in investigation of this point that this relation can only be held as approximately true; and I do not consider it as a rule worthy to be received in science, 'that the proportion of oxygen in all the alkaline bases taken together is unchangeable in all circumstances—upon whatever soil they may grow.' Neither has this rule been confirmed by experience.

"In the analyses that have hitherto been made the salts of all the organs of the plants, that is, of the contents of the cells, &c., have been analyzed together, and, therefore, no greater accuracy has been arrived at than can be attained by experiments in mass, which must necessarily always give but a certain approximation. But, besides, the ammonia is not to be overlooked, for this is an important base, which may undoubtedly replace the potash and soda of the food, and *vice versâ;* it must, therefore, have the greatest possible influence both on the quantity of the solid bases that have entered into the plant, and upon their products within the plant.

"The analyses of Berthier and De Saussure have shown a great difference between the proportions of the bases that are found in the same kinds of plants, grown on different soils. It appears to me that this difference is at least partly to be ascribed to a difference in the proportions of ammonia; this being a base through which all the acids the plants require can be supplied to it from the soil, forming salts with them that are very readily soluble.

"In short, if it is really a law that the quantity of oxygen contained in the bases of the plants is constant in the same species wherever it has grown, then it is equally true that this relation cannot be found by burning the plant and analyzing the ash, because one of the bases, viz., the ammonia, is volatilized by the combustion, and is not determined along with the others.

"It cannot be objected to this that nearly the whole of this ammonia, as a base, disappears in the plant, and is used in organized food in the same manner as carbon and oxygen. For we must consider, on the other hand, that the cellulose, in whatever form it may appear, that all the protein compounds, in a word, that all the solid parts of a plant, also remove a quantity of the potash, soda, lime, and magnesia, as so many bases with which they combine, and thus render them inaccessible to the action of the vegetable acids. Whilst, therefore, the ammonia passes into organic substances, the acids which were combined with it are set free; and again, whilst bases are combined with neutral substances, the acids that were united to these bases are also liberated.

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* Fownes ("Ann. de Chem. et de Phys.," Mars, 1845, p. 377) found that volcanic rocks, such as trachyte, basalt, lava, always contain phosphoric acid. This is of importance, and ought to be more carefully investigated.

† Chlorine has been observed to be given off by the leaves of plants. I differ from Mulder also in thinking that there is much reason to believe that common salt (chloride of sodium) is decomposed by plants. See my "Lectures on Agricultural Chemistry and Geology," 2d edition, p. 157.—*J.*

* Unger has classified plants according to the inorganic constituents which they take up from the soil.

"Although I conceive that there are a great many causes which may operate to produce a certain approximation, yet I consider the existence of the rule, as a rule, unproved; neither can it, in my opinion, be proved in the present time. If limited to the acids that are found in the contents of the cells, such as tartaric acid, &c., then no rule at all can be established, for there exist some acids in plants in a free state, such as the tannic acid, the citric acid, &c., and to these, therefore, the rule could not be applied.

"When the carbonic acid of the carbonates is replaced by some organic acid, under the co-operation of an additional quantity of carbonic acid, then there must necessarily be found a salt of an organic acid with an inorganic base, in proper chemical proportion. But in this case the law asserted by Liebig would imply that cream of tartar, for example, is represented by the formula:—

$$C_4 H_2 O_5, HO + C_4 H_2 O_5, KaO,$$

a truth which certainly nobody will call in question.

"What proportion the inorganic bases may bear to the neutral parts of the plant that have a definite form is at present still unknown, and as these parts contain no vegetable acids, but the bases are combined either with the cellulose or the incrusting matter, and mixed with other inorganic salts; and as, further, these parts with a definite form constitute the chief mass of a great number of plants, this still remains a point for investigation in vegetable chemistry, to be pursued in the same way as it has been carried on in animal chemistry with regard to the bones.

"Finally, the idea once current that plants can seek for bases in the soil according to their wants may be safely considered as erroneous. We do not know the existence of such a power in plants. But it has been found to be true that plants of different species placed close to each other in the same soil and under the same circumstances, after being burnt, leave different proportions of ash. This shows that, by a different degree of evaporation and other causes, plants absorb from the soil a different portion of water, and consequently, also, of the salts contained in it. This is the reason that some plants require for their existence a much moister soil, and water containing a greater proportion of salts than others. According to Berthier, 1,000 parts of oak wood left 25 parts of ash, whilst the same quantity of linden wood yielded 50 parts.

"It appears to me, therefore, that it is impossible to indicate any general law with regard to the presence of inorganic bases in plants. With the single exception of Mycoderma vini, all plants that have hitherto been analyzed contain inorganic constituents. It is known that part of them is combined with acids in such plants as contain acids; for instance, in the Peruvian bark, quinic acid is combined with lime; in the various kinds of sorrel, oxalic acid is combined with potash; and in the grasses, tartaric acid with potash and lime. But although they serve in the plants just mentioned, and in others containing acids, to neutralize these acids, and their quantity is necessarily proportionate to that of the latter, yet in a great number of plants those acids are wanting, although these very plants contain a considerable quantity of bases—and *vice versâ*, in some plants which are characterized by the presence of free acids, bases are not present. In every cell-wall, however young, in the spiral threads, in the incrusted ligneous cells, in short, everywhere, these bases are found. They are, therefore, indispensable to the life of plants; when they are wanting, the plant is languid, and does not produce that substance which it otherwise would, because it grows in a sickly manner. But this does not yet entitle us to conclude that the substance which is not produced in consequence of that sickly condition itself directly requires these bases for its production. Starch, for instance, contains almost no inorganic matter at all. Its production is possible without the direct influence of that inorganic matter. But the contents of the cells, through which the dextrin of the saps must be converted into starch, is disabled from performing this function, if they do not contain the requisite bases. It is from this cause that no starch is produced, although the latter does not itself require any bases. The same remark applies to the vegetable acids. If we should conclude that a plant which is deprived of the necessary quantity of potash does not produce any oxalate or tartrate of potash, because the acid that is to be formed finds no base to neutralize it, then, in my opinion, we should err. The want of potash makes the plant sickly; the substances that are present in it undergo a change, different from that which would have taken place had alkaline bases been present; and it is this general diseased state, which is an indirect effect of the absence of potash, that causes the non-production of oxalic or tartaric acid. A plant to which no inorganic substances at all are supplied produces nothing: we should, therefore, be equally justified in asserting that everything—for instance, the production of vegetable alkalis, ethereal oils, colouring matters, &c.—is effected by the inorganic bases, as we are in assuming that the production of acids is effected by them.

"This is the only connection that I can perceive between the proportions of acid which may be obtained by the analysis of a plant, and that of base which has been supplied to the latter as food. The larger the quantity of base—up to a certain limit—which can enter into a plant the more luxuriantly the plant will grow and produce its peculiar substances; the larger, for instance, will be the quantity of acid which is formed and at the same time fixed; that is, which will be removed beyond the change of materials in which every part of the plant is involved. It is, in my opinion, in this manner, and in this manner alone, that we can explain the otherwise mysterious phenomenon, that there is a regular proportion between the quantity of acid and base; for, whilst the acid is produced in the fruit, for instance, we cannot imagine that the roots possess the power of securing that a sufficient quantity of potash is supplied to the acid in the fruit. For this reason fruits remain sour in wet seasons; because from them that evaporation of water cannot take place, which promotes the entrance of vegetable sap into them, carrying with it a sufficient quantity of base to neutralize the acid. Hence ripe fruits ought to leave more ash than unripe ones, and we cannot, therefore, place implicit reliance on the analyses of Berard."*

To this paragraph Professor Johnston appends the following note:—"This mode of accounting for the sourness of fruits will not bear criticism, nor the conclusion drawn from it, that ripe fruits ought to contain more inorganic matter than unripe. If the organic acid which causes the sourness be transformed into sugar, the fruit becomes ripe without any necessary change in the proportion of inorganic matter." We, for our own part, concur most fully in these remarks and strictures.

"Finally, there is a greater or less quantity of free acid contained in sour and unripe fruits, which is a proof that the acid has been formed before a sufficient quantity of inorganic bases has been taken up; and which shows, therefore, that the quantity of acid prepared is not in proportion to that of the base which has been supplied.

"It follows from what has here been said, that I cannot subscribe to Liebig's opinion ('Journ. de Pharm. et de Chem,' 1843, tome iv., p. 87), concerning the function of the bases in plants, which he supposes to be the production of acids, and that I feel bound to view this important subject in the growth of plants in a different light.

* Johnston ("Elem. of Agric. Chem.") obtained from 1,000 parts of straw of unripe wheat, burned five weeks before its ripening, 40 parts of ash, whilst straw taken from the same clay soil after having come to maturity yielded 50 parts out of 1,000.

"ON THE OXIDIZING INFLUENCE OF THE ATMOSPHERE UPON THE SUBSTANCES PRODUCED BY PLANTS.

"It is altogether erroneous to suppose that everything which plants contain has been secreted and prepared by them in the form in which we find it; that is, that all this is the direct result of the change of materials within a plant. Every part of the plant, when exposed to the atmosphere, is always affected by its agency, provided it be capable of being so. Every substance that is present in plants, and is capable of absorbing oxygen, or producing new bodies by its influence, is always more or less changed by it, because the air has access to a great part of the interior of the plant.

"This influence, therefore, will vary with the degree in which the air can reach the substances that are capable of being changed, and also with the total or partial withdrawal of the action of other substances within the plant, that are capable of modifying the influence of the atmospheric air.

"The constituents of the juicy parts of plants are changed but little by the atmosphere, because they abound in a watery liquid containing little air, or none at all. This water protects the substances that are dissolved or diffused in it, or even those that have already been separated in the solid state, against the influence of the atmospheric air. All parts, however, that are less juicy, especially those that are old, in general all that are not saturated with watery liquid, are very much altered by this influence.

"Only a part of the five constituents of the atmosphere, water, ammonia, carbonic acid, oxygen, and nitrogen, can exercise here some particular influence. We may safely leave the nitrogen out of account, and likewise the water and carbonic acid, both that which is introduced through the roots, and that which is absorbed by the leaves, as far as they are not connected with nutrition, of which we have already treated before. All that remains, therefore, is the ammonia and the oxygen. The influence of the ammonia is very limited, as is shown by experience. The lichens, which yield litmus by the action of ammonia and oxygen, remain colourless in the atmosphere, from which it appears that the small quantity of ammonia which the atmosphere contains exerts upon them no influence whatever. We may assume the same with regard to other plants, with the single exception, perhaps, of the very delicate colouring substances of some flowers which, when placed in an atmosphere with ammonia and carbonic acid, actually appear otherwise than they would do after the removal of these two gases.

"Nothing else, therefore, remains to be considered but the oxidizing influence of the oxygen, which is unlimited in its effects, and therefore deserves our whole attention. It is the cause of the colouring matter in barks, of the long series of resins, and also of some vegetable acids that are found in plants, and would not exist there if the atmosphere contained no oxygen. If we glance through the various substances of the vegetable kingdom, we shall perceive that the atmosphere has an important influence, as it converts substances that were already secreted by plants into new products.

"The chemical composition of the various barks of woody plants is much more uniform than that of the wood of these plants. In the first place they contain the substances that have been carried down from the leaves. These substances are generally poor in oxygen or contain none at all, because a chemical change of a deoxidizing nature has taken place in the leaves, oxygen having been disengaged from them. It is for this reason that the ethereal oils and the resins produced from them are chiefly found in the parenchyme of the bark.

"Hence the general prevalence of the substances with which the barks of dicotyledonous woody plants are filled. These substances do

naturally differ from each other, but yet they belong to the same class of chemical bodies.

"But there is another reason why these barks agree so much with one another. The old barks which have burst by the increasing growth of the wood, and of which the vessels are pressed down, are converted by exposure to the atmosphere into an ulmic substance, which, having a brown colour, gives the same appearance, and even several identical properties, to old barks of very different trees.

"Besides this there occurs a product of decomposition of a constituent, which is common to a great many different barks, viz., the apotheme of tannic acid. This acid is certainly found also in herbaceous plants, in leaves and fruits, but its formation seems chiefly confined to the bark.

"These are, no doubt, the same substances that are mentioned in the investigation which I am about to quote, for it appears to me that the phlobaphen, as it is there called, closely corresponds with the humic substances formerly examined by me. Stähelin and Hofstetter have analyzed some kinds of bark ('Annalen der Chemie und Pharmacie,' Juli, 1844, s. 63), and obtained the following results.

"From the bark of Pinus sylvestris they extracted a kind of wax by means of ether. Subsequently, by digestion in alcohol, they obtained substances, one of which was precipitated by water in the form of reddish-brown flocks, whilst the liquid, which had an acid reaction, held another in solution. They called the former phlobaphen, and found it composed as follows :—

	Found.	Atoms.	Calculated.
C	62.78	20	62.77
H	4.30	8	4.12
O	32.92	8	33.10

It was soluble in ammonia, from which it was thrown down by a lead salt. The liquid, which had an acid reaction, gave a grey precipitate with salts of iron; it was yellow, and had an astringent taste. Its composition could be represented by the formula $C_{20}\ H_8\ O_{10}$; but it was a mixture of two substances, one of which was phlobaphen combined with an equivalent of water.

"When the bark, previously treated with ether and alcohol, was digested with alkaline carbonates, it yielded the same substance, and at last nothing remained but the skeleton of the bark, which was composed as follows :—

	Found.	Atoms.	Calculated.
C	52.20	34	52.20
H	5.61	21	5.30
O	42.19	21	42.50

Next to this skeleton the phlobaphen constitutes the greatest part of the bark, and gives it its brown colour.

"A similar substance they found in Platanus acerifolia, represented by the formula $C_{20}\ H_9\ O_8 + 2HO$; whilst the skeleton had the same composition as that from the Pinus.

"In China flava again they found a substance $= C_{20}\ H_8\ O_8$, but, besides this, another represented by the formula $C_{21}\ H_{12}\ O_7$.

"In Betula alba they obtained again the substance $C_{20}\ H_8\ O_8$ from the alcoholic solution, and from the alkaline one having the formula $C_{20}\ H_8\ O_8 + HO$.

"The temperature by which these substances were dried is only mentioned once, viz, 212° F. We rest, therefore, in uncertainty regarding the composition of these substances.

"We may, however, conclude from this investigation, in the first place, that in old barks a substance is present agreeing with the ulmic bodies in so far that it appears in two different conditions, one soluble in alcohol, and the other in alkalis. This is probably an apotheme. And in the second place, that the entire skeleton of old barks, after being treated with the above-mentioned solvents, appears to be nearly of a uniform composition."

Alfred Woollett, of Liverpool, artist, for improvements in gun carriages. Patent dated April 3d, 1849; six months.

THE CHEMICAL TIMES.

SATURDAY, APRIL 14, 1849.

PROSECUTION OF CHEMISTS BY THE MEDICAL PROTECTION SOCIETY.

We have received a number of letters from chemists and druggists (members of the Pharmaceutical Society) on the subject of the prosecutions which it seems are likely to follow upon that brought, *nominally* by the master and wardens of the Apothecaries' Company, but *virtually* by the Medical Protection Society, against Mr. R. L. Lobo, a chemist and druggist, who, it appears, has practised the art of medicine without the requisite legal qualification. Our correspondents call our attention to "The Medical Protection Circular" for March, where it is expressly stated that, according to the letter of the Apothecaries' Act, chemists and druggists have not even a right to make up a prescription, and that in doing so they subject themselves to a penalty for each case of transgression. The "Circular" shows pretty clearly the *animus* of the so-called Medical Protection Society, and it shows as plainly the gross ignorance of those who may be presumed to guide the operations of that body. Chemists are, as is well known to every member of the Pharmaceutical Society, exempted, by an express proviso, from the operation of the Apothecaries' Act, as far as the dispensing of medicines is concerned. As long, therefore, as they confine themselves strictly to their province, they need not be afraid of any attack from the Medical Protection Society, or any other body of the kind. Such attacks will undoubtedly be *tried* in a few instances; but they will *assuredly* and most *signally* fail; and the only danger that we can possibly foresee from them is, that the defendants in such actions may be frightened into a compromise, particularly in cases where medical *advice* may have been given by a chemist and druggist upon a sudden emergency.

Should any of our readers be made the subject of an unjust attack on the part of the Medical Protection Society, we would most strongly advise him not to compromise the affair, but to fight it boldly out in court, taking, of course, care not to conduct his own defence, but to entrust it to the hands of counsel versed in all the technicalities of the law. If he be a member of the Pharmaceutical Society, that body will, upon application to its council, assist him to the utmost of their power; and we flatter ourselves that the Medical Protection Society will find in it a much more formidable antagonist than the gentry composing it may anticipate.

It is deeply to be regretted that chemists and druggists do not always strictly confine themselves to their legitimate province, *i.e.*, the *dispensing* of medicines; but really, in most instances, their transgressions may almost be considered justifiable acts of self-defence against the encroachments of general practitioners. Upon this point one of our correspondents writes to us as follows:—"There are three general practitioners, one of them a M.R.C.S. and L.S.A., the other two L.L.S.A., in my immediate neighbourhood. They all three dispense not only their own prescriptions, but do not scruple even to make up physicians' prescriptions. Nay, one of them goes so far in the general line that he sells patent medicines, scent-bottles, perfumery, &c. About a fortnight ago a prescription intended for my shop, and *actually directed to me*, was carried by *mistake* to the *omnium gatherum* shop kept by that gentleman. Had this prescription been sent to me under such circumstances, with the address of another practitioner on the back of it, I should have directed the bearer to the proper address; but this *general* practitioner quietly made up the medicine, and pocketed the money; and when, having accidentally discovered the fact, I remonstrated with him upon the impropriety of this proceeding, he coolly told me that he considered *everything fish that came to his net*. Am I not, then, perfectly justified to retaliate upon people of this sort by poaching on *their* manor?"

For the honour of the medical profession we would gladly believe that cases like the one narrated by our correspondent are rare exceptions only. But we cannot shut our eyes to the fact that the general practitioners usurp almost wholly the legitimate business of the chemist and druggist, and that it is hardly to be wondered at, or even to be blamed, if the latter turn round upon the general practitioners and repay them in their own coin.

In our opinion the two functions—prescribing and dispensing—are wholly incompatible; and the sooner an entire separation is effected between them, the better both for the medical and chemical professions and the public.

THE SERPENTINE.

After all that has been said and written upon the muddy and unwholesome state of the Serpentine, and after all the admissions and promises of Lord Carlisle, we are equally surprised and grieved to see that matters are still, and are likely to be left, pretty much in the same state. A *partial* cleansing has indeed been effected, but the operation seems to have been confined to the *least* filthy spots. There appears to be an inconceivable unwillingness on the part of the Commissioners of the Woods and Forests to enter upon a thorough and effective cleansing of this Augean Pond, simply because an operation of such magnitude would require a considerable outlay of money, which the commissioners do not feel disposed to ask of our economical House of Commons. When the building of stables for her Majesty's horses, or of kennels for her Majesty's dogs, or the erection of an unsightly frontage to an unsightly building, called a palace by courtesy, are concerned, not the slightest hesitation is felt to ask the Commons for the requisite funds. But, if the subject simply concerns the health of the people and the general salubrity of the metropolis, economy is the order of the day. A few thousand pounds for such a purpose appear in the eyes of the Commissioners of Woods and Forests a fabulous sum which they could never make up their mind to ask for; whereas they have no objection whatsoever to demand hundreds of thousands for comparatively worthless purposes.

The filthy state of the Serpentine is positively a disgrace to the largest, the wealthiest, and the most populous metropolis in Europe. It is the imperative duty of the Commissioners of Woods and Forests to cause this state of things to cease, and we hope the public may yet find means to compel the performance of this duty.

PROCEEDINGS OF THE ROYAL SOCIETY.

PAPERS ON PHYSICAL AND CHEMICAL QUESTIONS.

December 14, 1848.—"On the Effect of Surrounding Media on Voltaie Ignition." By W. R. Grove, Esq., M.A., F.R.S.

The author refers to some experiments of his published in "The Philosophical Magazine" for December, 1845, and in the Bakerian lecture for 1847, relating to the difference of ignition generated in a platinum wire heated by the voltaie current when the wire is immersed in atmospheres of different gases. In the present paper these experiments are continued, the current being passed through two platinum wires both in the same voltaic circuit, but immersed in atmospheres of different gases.

It appears from these experiments that the heat generated in the wire is less in hydrogen and its compounds than in other gases, and that when the wires and their atmospheres of gas are immersed in given quantities of water the water surrounding the hydrogenous gases is less heated than that surrounding those which contain no hydrogen.

Similar experiments, in which the wires are immersed in different liquids, are then given; the heat developed appears not to depend on the specific heat of either the gases or the liquids.

The two series of experiments are brought into relation by one wire being immersed in hydrogen and the other in water, by which it appears that the cooling effect of the hydrogen nearly equals that of water.

Further experiments are then given, in order to ascertain, if possible, to what chemical or physical peculiarity these cooling effects are due; and from them it appears that they are not due to the specific gravity, specific heat, or to any conducting power of the gases for electricity, and that they do not follow the same law as that by which gases escape from minute apertures. They apparently depend upon some molecular character of the gases, by which either the interchange of hot and cold particles is facilitated, or a superficial action takes place, the surface of the hydrogenous gases presenting a more ready escape to the heat, similarly to that which has been long observed with regard to the different molecular constitutions of solid bodies, such, for instance, as the more rapid radiation or absorption of heat by black than by white surfaces, in the present case the epipolic action being dependent on the surface of the aëriform medium, and not on that of the solid substances.

January 11, 1849.—"On the Peculiar Cooling Effects of Hydrogen and its Compounds in Cases of Voltaic Ignition." By W. F. Stevenson, Esq., F.R.S.

In this communication the author gives several theorems which he considers to be established by the experiments cited in a pamphlet which he published, entitled "The Non-decomposition of Water distinctly Proved." He then states, that, when we apply the principle of these theorems to Mr. Grove's discovery of the cooling properties of hydrogen, it will be found to admit of a most simple solution: "for instance, when the coil of platinum wire is connected with the poles of the electric battery, and the current is established, it is evident that the electric matter thus passed through the wire must escape at the contrary end (the air with which the wire is surrounded not being a conductor of electricity), and as the quantity of electric matter thus transmitted is considerable, and its exit from the wire confined but rapid, that commotion before noticed (in one of the author's theorems) necessarily ensues and causes the ignition of the wire; but when the coil of wire is immersed in hydrogen, which is a conductor of electricity, it is evident that the electric matter must be, at the same moment, abstracted or conducted from every portion of the wire, and consequently the commotion or rush of the electric matter at the extremity of the wire, which causes the ignition, is suspended, and the comparative coolness of the wire is the necessary result."

Feb. 1.—"On the Chemistry of the Urine;" in three parts. By H. Bence Jones, M.D., M.A., F.R.S.

Part I. "On the Variations of the Acidity of the Urine in Health."

The mode of examination adopted by the author was the following:—Two test solutions were made; the one with carbonate of soda; the other with dilute sulphuric acid, of such strength that each measure of a graduated tube, when filled with either solution, was equivalent to one twelfth of a grain of dry and pure carbonate of soda.

A weighed quantity of urine was neutralized by one or other of the test solutions, and thus the degree of acidity or alkalescence was determined.

Diurnal variations in the acidity of the urine were observed. The acidity of the urine was found to ebb and flow; it was greatest a short time before food was taken, and was least about three hours after breakfast, and five or six hours after dinner, when it reached the minimum point: after which it again increased, and attained the maximum point previous to food being again taken.

By comparing the effect of vegetable food with animal food, it appeared that the food which irritated the stomach most, and caused most secretion of acid in the stomach, caused the greatest oscillations in the urine.

Dilute sulphuric acid taken in large doses produced but little effect on the variations of the acidity of the urine; but it was proved to increase the acidity of the urine.

Part II. "On the Simultaneous Variations of the Amount of Uric Acid and the Acidity of the Urine in a Healthy State."

The result of these experiments is, that there is no relation between the acidity of the urine and the amount of uric acid in it. The urine that was most acid contained least urie acid; that which contained most uric acid was not most acid. All food causes an increase in the amount of uric acid in the urine; and there is no decided difference between vegetable and animal food, either as to the increase or diminution of the amount of uric acid in the urine.

Part III. "Variations of the Sulphates in the Urine in the Healthy State, and on the Influence of Sulphurie Acid, Sulphur, and the Sulphates, on the Sulphates in the Urine."

The result of these experiments is, that the sulphates in the urine are much increased by food, whether it be vegetable or animal. Exercise does not produce a marked increase in the sulphates. Sulphuric acid, when taken in large quantity, increases the sulphates in the urine. In small quantity, even when long-continued, no effect on the amount of sulphates is manifest.

Sulphur taken as a medicine increases the sulphates in the urine. Sulphate of soda and sulphate of magnesia produce the most marked increase in the sulphates in the urine.

ON THE IDENTITY OF OIL OF TURPENTINE AND OIL OF LEMONS.

At the same sitting M. Dumas presented a communication on this subject from M. Henri Deville, professor at the Faculty of Sciences of Besançon. The author announces that he has succeeded in transforming the oil of turpentine into oil of lemons. M. Deville finds that the hydrated oil of turpentine, the composition of which is represented by the formula:—

$$C_{20}\,H_{16}\,H_6\,O_6,$$

loses two equivalents of water under the influence of a temperature but little above 212° F., or upon being placed in a vacuum the oil is in either case transformed into a hydrate with only four equivalents of water:—

$$C_{20}\,H_{16}\,H_4\,O_4,$$

but this, in whatever way obtained, quickly regains, on exposure to a moist atmosphere, the quantity of water necessary for its restoration to its primitive state. This fact appears very difficult to explain, as it is known that the two hydrates are almost insoluble in water. With hydrochlorie acid these hydrates yield water and an artificial camphor, analogous to that formed by the oil of lemons under similar circumstances, and yielding, when treated with potassium, an essential oil identical with the oil of lemons, in smell, boiling point, density, and composition.

MISCELLANEA.

M. BECQUEREL'S IMPROVEMENTS IN PHOTOGRAPHY.

It was announced many months since that M. Edmund Becquerel had discovered a process by which he was enabled to make photographie copies of coloured objects with distinct impressions of the colours on the body so copied. The *Comptes Rendus* of the 12th of February contains the report of MM. Biôt, Chevreul, and Regnault on M. Becquerel's memoir, entitled "On the Photo-chromatic Image of the Solar Spectrum." The prospect, however remote at present, of being able to copy nature in all the truth of colour gives great interest to every experiment which leads to an advance in this particular. The main features of the new process are the following:—The ordinary silver plate, well polished with English rouge or tripoli, is connected with the positive pole of a Bunsen's battery of two series, and then plunged into a large vessel containing 610 cubic inches of muriatic acid, diluted with about an equal quantity of water. In the same fluid is placed a thin plate of platina, which communicates with the negative pole of the battery. This plate is brought very rapidly a short distance from and parallel to the other. Under these conditions the plate assumes successively the colours of thin films; at first a grey, then a yellow and violet, tint, which soon passes to a blue, and to a green, becomes afterwards a light grey, then rose coloured, then violet, and at last blue. The operation must be stopped as soon as a lilac tint appears, the plate withdrawn rapidly from the bath, plunged into distilled water, and, being placed in an inclined position, dried over a spirit-lamp. The plates thus prepared may be preserved in the dark for a long time; and before they are used it is recommended to rub the surface with a little cotton, which renders it more brilliant, and the colours formed under the influence of the spectral rays more lively. In diffused light the surface of chloride of silver thus prepared becomes grey; but, if we project upon it a very pure and concentrated prismatic spectrum, it receives at different rates impressions from all the visible luminous rays in their respective colours, at the same time that very decided colours are obtained by the non-luminous rays, below the red, and beyond the violet. By warming the prepared plate some curious changes are produced; and if warmed on a stove to about 212° Fahrenheit M. Becquerel states that the most perfect condition for imprinting the spectral colours is brought about. The time which the plate should be exposed to the solar spectrum varies with its intensity; when very concentrated, in a few minutes a finely-coloured impression is obtained. The photo-chromatic images of M. Beequerel may be preserved for a considerable time in the dark; but as yet no means have been discovered by which they can be rendered permanent against the continued action of light. Admiring the zeal with which M. Edmund Becquerel has pursued his researches on this eurious subject, we must not forget that Sir John Herschel has long

since succeeded in obtaining a coloured impression of the spectrum on paper prepared with a vegetable juice; and that Mr. R. Hunt got a similar result with fluoride of silver. We may, therefore, reasonably hope that eventually the pencil of the sunbeam will add the charm of colour to the chemical pictures which it produces.—*Athenæum.*

ON THE EXISTENCE OF MERCURY IN THE TYROL.

M. Weidebusch, in analyzing in M. H. Rose's laboratory a specimen of tender grey copper ore, stated to be from Schwarz, in the Tyrol, found it to contain a notable quantity of mercury, amounting to 15.5 per cent. This grey copper is mixed with quartz and sulphuret of copper. Its powder is almost black, and has a specific gravity of 5.1075; when heated in a flask it yields a little metallic mercury with a light reddish-brown sublimate. It is mixed with carbonate of soda and heated: a larger quantity of mercury is obtained. It contains also zinc, iron, antimony, and sulphur, and traces of arsenic and silver. These substances exist in it in the same proportions as in other grey copper ores. A sample of crystallized grey copper, also stated to be from Schwarz, in the Tyrol, was found to be perfectly free from mercurial admixture. — *L'Institut*, Fevrier 21, 1849.

POISONOUS PAPER-HANGINGS.

Dr. Rasedon, of Mersburg, has directed the attention of medical men to the danger of using Scheele's green, either in painting walls or in staining paper-hangings. He thinks that by the agency of moisture a certain amount of arseniuretted hydrogen is evolved, which materially interferes with the purity of the air. According to Dr. Rasedon, pseudo-rheumatismal pains, neuralgia, cough, lassitude, and emaciation, are produced by that state of the air, and these affections get worse with an increase of moisture either in the room or atmosphere. The Government of Baden, acting upon this gentleman's suggestion, has prohibited the use of the arsenite of copper in the painting of rooms or paper, under a fine of from one to four pounds sterling. (It should be remembered, however, that in Silesia mortar is made by mixing a certain kind of arsenical sand with the lime, and that the people who inhabit houses for the building of which such mortar has been used complain of none of the ailments above mentioned.) The cases lately recorded at Marlborough and Tenterden ought to be a warning of the danger of using Scheele's green in cake ornaments.

MILK SECRETED BY THE KIDNEYS.

Urine of a milky appearance is a common occurrence, but there has been, till lately, no case recorded in which the urine has been found to contain all the component parts of milk. M. Reveil has just published one in the "Répertoire de Pharmacie." "I can certify," says this gentleman, "that in the case I am reporting the urine was voided in my presence, so that not the least suspicion of deception could be entertained. The subject is a child of twenty-two months old, being suckled by its mother, and I obtained its urine by receiving it in a very clean tumbler. I used to repeat the operation two or three times a day, at such hours as I was not expected in the ward, this case having occurred in the Hôpital Necker. The urine, when voided, was of a milky white with a yellowish tint; when allowed to stand a thick white and creamy layer formed on the surface, owing to the agglomeration of fatty particles; at the fundus of the vessel a white deposit was perceived, formed by a little mucus, caseïne, and a few butyrous globules. The urine is rendered transparent by ether; heat, however, coagulates it. By a subsequent very careful analysis the principal elements of milk, viz., the butyrous globules, caseïne, albumen, and sugar, were severally discovered. Whence comes this milk? How did it reach the bladder? These questions arise naturally in considering such an extraordinary phenomenon." The author, however, does not indulge in any attempt at resolving these questions. This reminds us very forcibly of the milky fluid which was lately drawn from a hydrocele by M. Vidal (de Cassis) at the Hôpital du Midi. Here the component parts of milk were also found, and the fluid, authentically analyzed, was presented to the Academy of Medicine of Paris.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Fennell Allman, of Charles-street, St. James's-square, Westminster, for certain improvements in apparatus for the production of light from electricity. Patent dated September 28th, 1848. Enrolled March 27th, 1849.

This specification is divided into two parts. The first part has exclusive reference to certain arrangements for regulating and maintaining the proper distance between the electrodes of electric apparatus for the production of light; the second part, to certain improvements in the batteries, or generators of currents of electricity applicable thereto. It is well known that the production of light from electric currents is best obtained by breaking the current conductor, and fixing at the ends of the broken parts two pieces of carbon for the current to pass through; or by using platinum, iridium, or some other comparatively infusible metal in conjunction with carbon; that is to say, by placing a piece of carbon on the positive or giving pole, or terminal point of the conducting wire, and one of the before-mentioned metals on the negative or receiving pole; it is also well known that for the production of a good light three things must necessarily be complied with. First, the terminal points—or, as they are commonly termed, electrodes—must be brought into actual contact with each other. Secondly, on the current being passed through, they must be separated a limited distance; and, thirdly, this distance must be maintained and regulated in proportion as the current of electricity varies both in quantity and intensity, and as the carbon or other electrodes become consumed or dissipated from other causes. Many arrangements have been proposed for attaining the above objects, but difficulties have arisen in practice, which partially, if not wholly, destroy their efficiency for the purposes of illumination; columns of carbon have been used as electrodes, the lower one being placed upon a non-conductor; discs of carbon have been used, the light being produced between their edges; motion has been also given to the electrodes by a train of wheels, acting as clockwork, for maintaining the required distance between them, such machinery being regulated according to the strength of the induced current. Currents of electricity have also been made to pass through a coil of wire within which a piece of soft iron is placed; the induced current in its passage through the wire causing the iron to rise and fall within the coil, according to the strength of the electric current at the moment, and regulating the machinery and electrodes as before described. The patentee proposes a new arrangement of apparatus differing from any of the means hitherto used; the separating and maintaining the electrodes at a proper distance for the production of a steady light being effected by the electric current, without auxiliary power or assistance. The apparatus by which the patentee proposes to effect the object in view is illustrated by engravings which accompany the specification. The apparatus is constructed essentially of a magnet composed of plates of steel, which, previous to the forming of the magnet, have been made permanently magnetic. The magnet is centered upon a spindle, and lies parallel to two coils of copper wire or ribbon; the patentee prefers these coils to be composed of about twenty-four convolutions of broad copper ribbon. The copper coils are enclosed in a case; a weight (with counterpoise) is placed upon the spindle of the magnet for the purpose of keeping one end of the magnet down; this may be fixed in any position around the spindle by means of a small set-screw. The induced current passes in and through the coils along the case enclosing the latter to a bracket or arm affixed to this case, and from thence along a piece of thin silver foil to the holder of the upper electrode, and through the under electrode and its holder, and, finally, back again to the battery. During the passage of the current in this manner through the apparatus the two first-named requisite conditions are fulfilled, namely, the actual contact of the electrodes, and their subsequent separation, caused by the well-known deflection of the magnet, which raises the upper electrode by the intervention of a rod. The third condition will follow as a necessary consequence, for, as the electric current causes a separation of the electrodes (and too great a separation would break the circuit), and as the weight which presses on the spindle upon which the magnet is centered, and which acts as the antagonistic force to the dynamic effect of the current, would always bring the electrodes in contact upon the current being broken, it follows that a proper distance will be constantly maintained between the electrodes. In working the apparatus it would be necessary to push up the lower electrode through its holder, and with it the upper electrode and the magnet, until the latter lies at an angle of about 30° to the direction of the current in its passage through the coils of copper ribbon; the wider such ribbon is used the longer will be the deflection of the magnet, that is to say, the greater will be the angle at which the deflective force will have effect. On the current being passed through, the magnet will be still further deflected, and the electrodes separated a proper distance; this will continue to be the case during the consumption of the carbon, until the magnet be brought back to the horizontal position. As the deflective force of the current becomes weaker as the angle of the magnet increases, the weight which presses on the spindle should also lessen in a like proportion; this is effected by the latter leaning more over the centre of the spindle as the angle increases. In another arrangement of the patentee the preceding objects are attained by the combination of a permanent magnet with induced or temporary magnets; the temporary magnets being composed of pieces of soft iron enclosed within coils of ribbon or wire insulated in the usual manner, one being placed at each end of the permanent magnet centered as before described; the repulsive force of the like poles of the permanent and induced magnets being rendered available for the raising of the upper electrode, the other parts being arranged as in the preceding case.

The patentee gives a third modification, in which four temporary or induced magnets are used, one of them being fixed at each end of a lever centered and weighted, and connected with the electrodes as described. The other two magnets are fixed and placed opposite to the two first, like poles, being presented to each other. It is evident that, upon a current of electricity being passed through the coils surrounding the pieces of soft iron thus rendered magnetic, those placed at each end of the lever will be repelled, causing the upper electrode to be raised as desired. In all the arrangements hitherto described the repulsive force alone is made use of; but by reversing the arrangement, opposite poles being presented to each other, the attractive force may be made use of to raise and keep the electrodes apart.

Another of the effects produced by currents of electricity is made use of for maintaining the electrodes apart for the production of the phenomenon of light, viz., the well-known calorific effect produced by passing a strong current of voltaic or other electricity through too small a

conductor. Two mechanical arrangements in connection with the carbon or luminous terminals of the circuit are described by the patentee. In one case the passage of the current is more or less obstructed, as desired, by causing it to pass through a jointed rod of metal in its passage to the electrodes. At the joining of the two parts of the rod a plug is fitted of a semicircular or D shape, through which the current must pass, so that, by turning the plug round, more or less of its surface may be presented to the ends of the adjoining metal rods. Supposing the plug to be so turned that very little surface be presented, the rods will necessarily become heated and elongated accordingly, such elongation being rendered available through the intervention of suitable springs and levers for raising the upper electrode.

The second method described is by making the current pass through a compound conducting-rod of steel and brass rivetted together, so that as the electric current heats the rod it will become bent, owing to the unequal expansion of the two metals under equal temperature; that side towards which the brass is placed becoming the convex, and the steel side the concave, surface; this bending of the conducting-rod serves to raise the upper electrode.

In the next and last arrangement the management of the electrodes is effected by the decomposing action of a voltaic or other current of electricity; this arrangement may be also applied to show the "intensity effect," as it is termed, of the current used. The apparatus described consists of a cylindrical brass vessel, within which is a glass cylindrical vessel fitted with a cover, to which is fixed a tube passing up vertically through guides in the upper part of the brass vessel, and capable of sliding up and down therein. Within this inner glass vessel are suspended two plates of platinum, about five inches long, by two and a half wide, and about a quarter of an inch apart; these plates act as a common voltameter. Around the inner glass vessel is placed a concentric vessel of glass, which contains the liquid to be decomposed (sulphuric acid and water). Now, on a proper connection being made with the voltaic or other battery, as the current passes through the plates of platinum, and away through the electrodes back to the battery, the liquid contained in the apparatus will be decomposed, and the gases arising therefrom will force up the inner glass vessel and tube, upon which is placed a button pressing upon levers, the opposite ends of which levers respectively separate the electrodes a sufficient distance apart, and move an arm or indicator before a dialplate, showing the intensity and variations of the electric current passing through the apparatus. The gases are allowed to escape through a small opening in the upper part of the tube, such opening being so regulated by a screw as to prevent the gases becoming too condensed, and raising the inner glass vessel too much, which would tend to part the electrodes too widely, and thus to extinguishing light.

The last part of the invention relates to the batteries employed for the production of light, and is confined to the egress and ingress of the acid or other liquid employed therein. The carrying off of the exhausted liquid is effected by a syphon, one leg of which dips into the liquid in that part of the battery from which it is to be drawn off; the opposite leg dipping into a vessel suspended from one end of a centered lever. The top of this vessel must be rather below the level of the liquid in the battery; it must also be kept full, and balanced by a weight at the opposite end of the beam or lever. Now, as the exhausted liquid from the battery passes off through the syphon (supposing the liquid to be over exhausted, and a heavy liquid, such as sulphate of zinc, to pass through the syphon into the suspended receiving-vessel), the vessel of liquid will overbalance the weight at the opposite end of the lever, thereby lengthening the leg of the syphon at that side, and increasing the flow until the liquid passing from the battery be of the density desired for the efficient working of the apparatus producing the light. Another means is described for effecting the same object, by regulating the flowing off of the exhausted liquid from the battery by a hollow ballcock. When the liquid is over saturated, or more dense than desired, it will have the effect of partially raising the ball, and increasing the opening through which the liquid passes from the battery. In some cases the patentee makes use of forcepumps, or other hydraulic machinery worked by some power or force, such as is commonly used for forcing or raising liquids, for the purpose of supplying the necessary quantity of liquid to the batteries, thereby avoiding much labour and expense, when the batteries are stationed at a distance from the supply reservoir, or when placed upon different levels.

After describing the nature of his inventions, and the several manners in which the same can be practically carried out, the patentee claims:—

First. The exclusive use of a conductor or conductors of voltaic or other electricity, in connection with a permanent magnet or magnets, as an improvement in apparatus for the production of light from electricity.

Secondly. The use of permanent and induced or temporary magnets in conjunction, as an improvement in apparatus for the production of light from electricity.

Thirdly. The employment or use of conductors of voltaic or other currents of electricity, arranged in such a manner that the like poles of such conductors are presented so as to repel each other, as an improvement in apparatus for the production of light from electricity.

Fourthly. The use of conductors of currents of electricity in conjunction with temporary or induced magnets, or of induced magnets alone, as an improvement in apparatus for the production of light from electricity.

Fifthly. He claims as his invention the methods described, or any other means whereby the calorific effects of currents of voltaic or other electrictiy are made available for the management of the electrodes in apparatus for the production of light from electricity.

Sixthly. The arrangement described, or any other modification thereof, whereby the decomposing effects of currents of electricity are rendered available for separating and maintaining the electrodes or luminous terminals of the current at a limited distance, as an improvement in apparatus for the production of light from electricity; also the use of the voltameter as described.

Seventhly. The apparatus or arrangements described, or any modification thereof, whereby the drawing off of the exhausted liquid from a battery is entirely governed by the gravity or density of the liquid.

Eighthly. The use of forcepumps and other hydraulic machinery or apparatus, in connection with electric batteries for the production of light.

Andrew Paton Halliday, of Manchester, manufacturing chemist, for certain improvements in the manufacture of pyroligneous acid. Patent dated Sept. 28th, 1848. Enrolled March 28th, 1849.

This specification relates to certain improved methods of obtaining pyroligneous acid from the substances usually used for such purpose. Pyroligneous acid has hitherto been usually obtained by the destructive distillation of oak or other wood. The process mostly in use now is as follows:—Branches or billets of oak or other wood are placed in a cylindrical tube, or retort; the external surface of the latter is heated from a furnace or by some other suitable means; the wood in the retort becomes carbonized, and the gas evolved is carried away through a pipe (which opens into the retort), either direct or through an intervening main to the condenser, which usually consists of a number of pipes or tubes immersed in water, through which the manufactured gas passes. It is also well known that sawdust, wood-turnings, wood-chips, spent dyewoods, spent tan and peat, have likewise occasionally been used for the manufacture of pyroligneous acid; the process being almost the same as that just now described for the destructive distillation of branches or billets of wood. These substances (sawdust, wood-turnings, &c.) yield, however, only comparatively small quantity of acid, owing to the minute division of the molecules; for, upon the retort being charged and heated, the particles of matter in immediate contact with the inner surface of the retort become completely charred, while the particles near the centre of the retort are scarcely affected, in consequence of the non-conducting quality of the coating of charcoal thus formed around them. Now, the object of this invention is, to utilize these before-mentioned materials, or any other similar vegetable substances, and to produce therefrom a much larger proportion of acid than the old process will yield. In carrying out these improvements, a retort may be made use of, and heated by a furnace in the usual manner; the raw material is introduced into a hopper, whence it is fed through a pipe by means of a screw revolving in the latter to the retort, which has also a screw of about the same diameter as the one inside. A revolving motion being given to the screw in the feeding-pipe, by means of a steam-engine or some other appliance of the kind, the material is passed gradually, in a state of commotion, through the heated retort. At the extreme end of the retort two pipes branch off, one passing downwards and dipping into a vessel or cistern of water, into which the carbonized substance falls; the other pipe passes upwards, for the conveyance of the gases given off during the destructive distillation of the material to a main conduit-pipe leading to the condenser, which may be constructed according to any of the approved modes now in use.

The velocity of the motion imparted to the revolving screw is to be regulated in proportion to the rapidity of the destructive distillation, and to the quality of material used, as determined by experience. It will thus be seen that any of the before-named substances may be economically used, such substances being properly and perfectly carbonized in being passed by this means in a state of commotion through the retort. The other products of the destructive distillation may be applied to the purposes for which they are generally used.

The patentee proposes also another method of manufacturing pyroligneous acid. This method is as follows:—

In lieu of the ordinary retort as before described, a double pipe or tube is made use of, a space of a few inches being left between the two component tubes or pipes. The inner pipe is for holding any of the before-mentioned substances to be distilled, and the space between the two pipes for the passage of steam, for the purpose of raising the temperature of the inner tube as desired. A pipe passes out near the top of the retort, through which the pyroligneous gas and waste steam passes to the condenser. The whole apparatus (that is the retort, formed by the two tubes) is placed on end, and the steam passed in through the bottom cover of the tubes. The patentee prefers the outer casing of the retort to be made of cast iron or firebrick; in case of branches or billets of wood being used, the inner tube may be made of strong iron wire, or of wire gauze; if any of the more minutely divided substances before mentioned be made use of, a cylinder of iron perforated with a multitude of minute holes will answer best for the inner tube.

The patentee claims:—

First. The means described and explained for the destructive distillation of sawdust, wood-turnings, wood-chips, spent dyewoods, spent tan, peat, or other ligneous substances, in the manufacture of pyroligneous acid, and the machinery, before described, for effecting such distillation.

Secondly. The means described of manufacturing pyroligneous acid from any of the before-mentioned or other similar substances by means

of steam, in the manner explained, or any modification thereof.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING APRIL 3D, 1849.

A grant of an extension of an invention for the term of four years from the 4th instant for a certain improvement or improvements in the making and manufacturing of axletrees, for carriages and other cylindrical and conical shafts. To Charles Geach and Thomas Walker, assignees of James Hardy, the original inventor.

William M'Bride, jun., of Sligo, in the kingdom of Ireland, but now of Harve, in the Republic of France, merchant, for improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water. Patent dated April 2d, 1849; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in separating and assorting solid materials or substances of different specific gravities. Patent dated April 2d, 1849; six months.—(Communication).

Samuel Alfred Carpenter, of Birmingham, in the county of Warwick, manufacturer, for a certain improvement in, or a substitute for, buckles. Patent dated April 3d, 1849; six months.

William Parry, of Plymouth, in the county of Devon, Esq., for certain improvements in shoeing horses, and in horseshoes. Patent dated April 3d, 1849; six months.

Henry Dunington, of Nottingham, manufacturer, for improvements in the manufacture of looped fabrics, and in the making of gloves and hatbands. Patent dated April 3d, 1849; six months.

James Godfrey Wilson, engineer, of Chelsea, and William Pidding, of Elizabeth-street, Pimlico, for improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable to every description of furnace and fireplace, as also to other purposes where inflammable matter or material is made use of. Patent dated April 3d, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND FROM THE 22D OF FEBRUARY, 1849, TO THE 22D OF MARCH, 1849, INCLUSIVE.

Samuel Wellman Wright, of Chalford, in the county of Gloucester, civil engineer, for certain improvements in preparing fibrous substances for spinning, and in machinery and apparatus connected therewith. Sealed 28th February, 1849; six months.

Michael Loam, of Treskerley, in the parish of Gwennap, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees. Sealed 28th February, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for a certain improvement or improvements in the construction of wheels. Sealed 5th March, 1849; six months.

Robert Johnson, of Holly-hall Works, near Dudley, in the county of Stafford, engineer, for improvements in the manufacture of stoves. Sealed 5th March, 1849; four months.

John Smith, of Hare Craig, Dundee, factor to Lord Douglas, of Douglas, for improvements in the manufacture of flour, applicable in the making of bread, biscuits, and pastry. Sealed 6th March, 1849; six months.

William Edward Staite, of Throgmorton-street, in the city of London, civil engineer, for improvements in the construction of galvanic batteries, in the formation of magnets, and in the application of electricity and magnetism for the purpose of lighting and signalizing; as also a mode or modes of employing the said galvanic batteries, or some of them, for the purpose of obtaining chemical products. Sealed 7th March, 1849; six months.

Charles Thomas Pearce, of Park-road, Regent's-park, in the county of Middlesex, Esq., for improvements in apparatus for obtaining light by electric agency. Sealed 7th March, 1849; six months.

Richard Laming, of Clichy la Garonne, in the Republic of France, chemist, for improvements in the modes of obtaining or manufacturing sulphuric acid. Sealed 9th March, 1849; six months.

George Nasmyth, of Great George-street, in the city of Westminster, civil engineer, for certain improvements in the construction of fireproof flooring and roofing, which improvements are also applicable to the construction of viaducts, aqueducts, and culverts. Sealed 12th March, 1849; four months.

Thomas Henry Russell, of Wednesbury, patent tube-manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron, and certain other metals and alloys of metals. Sealed 13th March, 1849; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters, and in the manufacture of candles and night lights. Sealed 13th March, 1849; six months.

Charles Robert Collins, of Brunswick-street, in the city of Glasgow, North Britain, paper-manufacturer, for a certain improvement or improvements in the manufacture of paper. Sealed 14th March, 1849; four months.

John Hick, of Bolton-le-Moors, in the county of Lancaster, engineer, and William Hodgson Gratrix, of Salford, in the county of Lancaster, engineer, for certain improvements in steam-engines, which improvements are more particularly applicable to marine-engines; and also improvements in machinery or apparatus for propelling vessels. Sealed 16th March, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in engines or apparatus, principally designed for pumping water. Sealed 19th March, 1849; six months.

William Galloway and John Galloway, of Knott-mill Ironworks, Hulme, in the borough of Manchester, and county of Lancaster, engineers, for certain improvements in steam-engines. Sealed 21st of March, 1849; four months.

Thomas Robinson, of Leeds, in the county of York, flaxdresser, for improvements in machinery for breaking, scutching, cutting, heckling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. Sealed 21st March, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND FROM THE 20TH OF FEBRUARY, 1849, TO THE 20TH OF MARCH, 1849, INCLUSIVE.

William Martin, of St. Pierre les Calais, in the Republic of France, mechanist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and to printing and other like purposes. Sealed 21st February, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. Fenton, of Sydenham, for a composition or material to be used as a substitute for soap. Patent dated April 3d, 1835; expired April 3d, 1849.

H. W. Nunn, of Newport, for improvements in manufacturing the ornamental parts of lace, and producing ornamented or embroidered lace. Patent dated April 3d, 1835; expired April 3d, 1849.

G. E. Donisthorpe, of Leicester, and H. Rawson, for certain improvements in the combing of wool and other fibrous substances. Patent dated April 3d, 1835; expired April 3d, 1849.

R. Gillespie, of Piccadilly, for certain improvements in trusses or instruments for the cure of hernia or rupture. Patent dated April 3d, 1835; expired April 3d, 1849.—(Communication.)

J. Hardy, of Wednesbury, for a certain improvement or improvements in the making or manufacturing of axletrees for carriages and other cylindrical or conical shafts. Patent dated April 4th, 1835; expired April 4th, 1849.

USES OF HORSE-CHESNUTS.

M. Chevalier, at the close of certain investigations he has made concerning the horse-chesnut (Æsculus hippocast, L.), has stated:—1st. The fruit of the horse-chesnut-tree can be used for the food of cattle, or the fattening of fowls, either decorticated or not, freed or not of its bitter principle, either in paste or powder. 2d. It will yield a starchy fæcula, useful for food, or which may be turned into glucose, alcohol, &c.; or used as paste for washing the hands; for making bookbinders', weavers', or paper-stainers' glue, for manufacturing pasteboard, oil for burning, and resins which may be added to varnish; or lastly, for making a liquid useful in the washing of linen and the steeping of flax. 3d. It may be used as fuel; the ashes will answer very well for the production of potash, and as a remedy for certain complaints which affect domestic animals; the wood finally may serve to make thin planks, and may be used also for engraving or turning.

BIRTHS AND DEATHS IN LONDON DURING THE WEEK ENDING SATURDAY LAST.—The return of the Registrar-General of births and deaths in the metropolis during the week ending on Saturday last shows the number of deaths from all causes to be 994, being thirty-one more than the weekly average of five springs. The return, however, shows that the public health improves with the progress of the early months, and that the mortality has fallen to the rate of that of October. The fatal cases of cholera are thus given:—Kensington; Town.—F. 28, "malignant cholera, and not injuries by violence alleged to have been done to her"—inquest. St. Martin-in-the-Fields; Charing-cross.—F. 38, "cholera spasmodica (10 hours)." Mr. Leonard, the registrar, states that "the deceased was reported as a charwoman, but, in fact, was an unfortunate female of intemperate habits, brought to the workhouse at six p.m. on the 7th inst. in a state of collapse. The house-surgeon and assistant gave immediate attendance, and at half-past nine the district surgeon also: death occurred at ten p.m. On the morning of Easter Sunday the district officer of health visited the house, No. 5, Hanover-court, Long-acre, and reported it to be a 'house of accommodation.' In a small yard, about four feet by ten feet, is a deep cesspool, not sufficiently protected, and very offensive. The under part of the house receives the dust and refuse; and the drain-water from the small yard runs in a pipe into the cellar, and is caught in a tub or butt. The rooms, which are two on a floor, are cleanly kept. The two officers of health visited this house on the 26th of August last year, and from notes then taken I find that over a surface of about 6,480 square feet there is no surface drainage, or very insufficient; that the cesspool of the above house had been emptied about the 17th of July of the same year, and that there appeared to be no drain. The next house has also arrangements of the very worst possible description." St. Pancras; Camden-town.—M. 34, "Asiatic cholera, active symptoms (18 hours); continued fever (3 days)." Mr. Barth, medical attendant, states, that "all the symptoms of Asiatic cholera were well marked in the patient except cramps, which were very partial, and restricted to the upper extremities. Lips and face blue, and collapse, diarrhœa, rice-water. Transfusion of thirty ounces of blood was tried while in collapse, which rallied him for a day, but he died three days afterwards of continued fever." Greenwich; Woolwich Arsenal.—

In Royal Ordnance Hospital, M. 23, "debility (20 days); cholera biliosa (18 hours);" Greenwich West.—In Dreadnought Hospital, M. 14, "cholera," p.m. The number of births registered in the week was 1,225.

THE CHOLERA IN PARIS.—The number of cholera cases admitted into the hospitals in Paris during the last two days has diminished. It was 34, while in the preceding days it was 62. The number of cases in the different civil and military hospitals, from its first invasion, has been, according to the *Union Médicale*, 1,009, of whom 563 have died. The mortality differs remarkably in the military hospitals from that in the other similar establishments. Hitherto in the first it has been but a little more than one third, while in the others it has been 59 in 100. This difference is explained by the dissimilarity between the two classes, and more particularly by the frightful mortality at the Saltpetrière. In this asylum for old age the disease continues its ravages upon a par with those of 1832. Within the last two days there have been 89 new cases, which make the total amount to 419, among whom there have been 279 deaths. It is not only the infirm and incurable that are attacked; the ward for lunatics, which is filled with women of all ages, furnishes an equal number of victims. The persons employed in the infirmary and other parts of the hospital have been attacked in great numbers, and two outdoor students in medicine have very nearly fallen victims to their zeal. The directors of the hospitals, who have been seconded by all the medical men of the Saltpetrière with the most admirable zeal and courage, have come to the only resolution which can have efficacy, and that is to reduce the accumulation of 6,000 persons, the amount of its population, by disseminating them. All the women who are able to leave the establishment will be desired to return to their families, and as long as they remain out they will receive a daily relief of 75 centimes. Notwithstanding the reports of the slight intensity and prevalence of the cholera, much alarm prevails respecting it in Paris, several persons of note having already died of it. This fact alone is sufficient to explain the public uneasiness. Fifteen members of the Assembly are said to have been attacked, five of whom are already reported dead. Several cases of death by the epidemic among the upper classes have also been reported. Among the representatives attacked by cholera is stated the name of M. Payer, formerly secretary to M. de Lamartine.—*Galignani's Messenger*, April 9.

APOTHECARIES'-HALL.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, April 5, 1849:—George King, Calne, Wilts; John Rorie, Plymouth; John Wilcocks Wakem, Truro, Cornwall; Edward John Vivian; Joseph Powell Swanwick, Prestbury, Cheshire; John Buncombe, Taunton, Somerset; John Dix, Smallburgh, Norfolk; Theobald Ringer, Langhame, Carmarthenshire; Charles Anthony Floyer, Floore, Northamptonshire; Richard Edmonds Price, Marlborough, Wilts; Edward Leopard Neville, Esher, Surrey; Edward Buckell, Chichester; John Weekes, Tavistock, Devonshire; Franklen George Evans, Cardiff, Glamorganshire; William Kitchen Parker, Peterborough; Samuel Atkinson Brough, Marlborough, Wilts; George Smith, Axbridge, Somerset; Richard Pope Jeston, Henley-on-Thames, Oxon.

ROYAL COLLEGE OF SURGEONS.—The following members of the college having undergone the necessary examinations were admitted "fellows" at the last meeting of the council, viz., Messrs. Edgar Barker, Edgware-road, diploma dated March 5, 1824; Henry Butler, Hobart-town, Van Diemen's Land, July 28, 1843; William Henry Colborne, Chippenham, July 17, 1846; John Cooper Forster, Wellington-street, Southwark, November 15, 1844; John Havers, Bedford-place, Russell-square, December 15, 1837; Thomas Brooks Larkins, Hon. East India Company's Bombay Service, December 23, 1836; and Anthony Sargeant, Meriden, Warwickshire, November 19, 1841.

THE PITCH LAKE.—Earl Dundonald having made a communication to his Excellency Lord Harris on the subject of the capabilities of the asphaltum of the celebrated Pitch Lake as fuel, the *Port of Spain Gazette* adds:—"From time to time the practicability of using pitch as a fuel for the generating of steam, both as regards land and marine engines, has been brought before the public; but, either from the absence of any pretensions to reputation for scientific research in this colony, or failure, whole or partial, in the experiments made to test the practicability of the scheme, the public have been led at first to doubt, and latterly totally to disbelieve, the possibility of the useful adaptation of pitch as fuel. But the importance which attaches to any opinion on such a subject expressed by a man of Earl Dundonald's standing in the scientific world, and the extremely satisfactory results of his lordship's experiments, circumscribed as they could not but be under the circumstances, will, we trust, be sufficient to attract anew attention to this important subject, and to awaken the notice of a high and eligible commercial body; more particularly do we hope the subject will attract the attention of the Royal Mail Steam Packet Company, whose intercolonial steamers consume a vast quantity of coal, conveyed at great cost from England to the several depôts, for the whole of which, under a proper adaptation of their furnaces, the pitch might prove a cheap and effectual substitute. No costly 'plant' in the shape of buildings would be necessary for this purpose, nor would any expensive agency for the digging of the pitch and conveying it to the shipping-place be required. Contracts to furnish the necessary number of tons of pitch at stated periods would be readily entered into by competent contractors; and the seaboard of the lake would afford full facility for shipping purposes. The first step the company would take, we presume, would be the submitting the pitch to a series of accurate experiments in a laboratory to test its powers of generating caloric, as compared with the power of coal; but, that this point may be satisfactorily tried, great care should be taken that the pure pitch of the lake, and none other, be used in these experiments. Many years ago a celebrated chemist analyzed what he understood to be a specimen of pitch from the Trinidad lake, and pronounced it to be mere porous stone. It was afterwards discovered that the substance used in the experiment was a very inferior specimen of the mixture of earth and pitch to be found in the neighbourhood of San Fernando."

TO CORRESPONDENTS.

ERRATUM.—Page 301, col. 3, lines 45 and 50 from the top, *instead* of 156° or 154° F., *read* 136° or 140° Fahrenheit.

"Subscriber" wants to know who is, in our opinion, the best surgeon-dentist in London; and whether his charges are moderate. The metropolis contains a number of first-rate surgeon-dentists; the pointing out of *one* among them as *the best* would be a great injustice, indeed, to the others. We are afraid our correspondent will not find *excellency* go hand in hand with *cheapness*.

"A New Subscriber." — Ambergris comes from Holland, Africa, Brazil, and the East and West Indies, where it is found floating on the sea. That which is grey, very light, and easy to break, is the best; the inferior sorts are brown or black, heavy, and difficult to break. Ambergris is frequently adulterated with wax, storax, gums, and white writing-sand, which admixtures may be detected by inspection through a magnifying-glass, or by thrusting into the suspected pieces a red-hot needle, when the smell emitted will betray the adulteration.

"A Subscriber from the Commencement" is referred to No. 62 of the *Pharmaceutical Times*.

"W. R.," and a number of other correspondents, will see that we have resumed in this number the Lectures on Pharmacy by Professor Soubeiran.

"P. T."—"Noad's Treatise on Chemical Analysis" will answer the purpose.

"Mr. Milman, Coventry."—Address a letter to the patentee, 14, Pall-mall East.

"G. R."—The affair is mere moonshine.

"Mr. Waller."—Be cautious. The advantages which the patentee offers you in exchange for your capital appear very great indeed; but, in our opinion, the article which it is intended to manufacture will only meet with a limited sale, and in the end you may lose both interest and capital.

"A Novice."—We are afraid you are not yet sufficiently advanced in the elements of chemistry to derive any great advantage from attending the Royal College of Chemistry. We would advise you to procure "Fresenius' Qualitative Analysis," and to act strictly up to the instructions given therein.

"Mr. Reynolds."—The real arrack is an Eastern spirit, distilled usually from palm juice, but also from rice and other grain. A tolerable imitation of it may be produced, however, by dissolving 40 grains of benzoïc acid in a quart of rum.

"Mr. J. Ross, Glasgow."—Copal is brought from America and the East Indies. It is used chiefly for making varnishes, though it enters sometimes also into the composition of plasters. The best copal is hard, brittle, in rounded lumps, and easily reduced to fine powder. Copal often contains, like amber, insects. It is also frequently adulterated with anime, a substance greatly resembling copal, but of inferior value in varnishing. This adulteration may be detected by treating the suspected samples with spirits of wine: the anime dissolves readily in this menstruum whereas the copal is only sparingly soluble in it. Copal is difficultly soluble in alcohol and in essential oils. It dissolves with greater readiness in an alcoholic solution of camphor. It will dissolve also with considerable facility in pure alcohol, if it be previously heated over the fire. To prepare solution of copal in essence of turpentine, take two ounces of oil of lavender, heat in a glass matras, and add gradually one ounce of coarsely-powdered copal, stirring the mixture with a stick of white wood. When the copal is dissolved, add six ounces of oil of turpentine heated nearly to boiling, and stir the mixture well.

"J. R. S."—We are sorry we cannot assist you—the matter lies not in our department.

"B. L. (a subscriber from the commencement)."—We have answered the same question over and over again. We must refer our correspondent to the back numbers.

"Tyro."—Apply to Professor Hofmann, of the Royal College of Chemistry, Hanover-square.

"Chemicus." — Trifling errors will occasionally occur. It should have been nitric acid, as the formula appended (NO_5) fully proved.

"L. R. N."—We do not know the author of the work in question. Mr. Churchill, of Princes-street, Leicester-square, may, perhaps, be able to give you the desired information.

"A Constant Reader."—Morison's pills contain gamboge, which drug is a drastic purgative, and acts as a violent poison when taken in any notable quantity. Our correspondent had better beware of all quack medicines.

"Mr. Stanfield, Liverpool."—The odoriferous essence or tincture is prepared as follows:—Take grain musk and balsam of Peru, of each 11 grains; civet and oil of cloves, of each 5 grains; oil of rhodium, 2 grains; salt of tartar, 30 grains; alcohol, 2 ounces. Macerate for a fortnight; pour off the clear fluid.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London; and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—April 14, 1849.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Continued from page* 297.]

THE OPERATION OF REFINING.

The term "sugar-refining" is applied, as is well known, to the operation, or a series of operations, by means of which the dark impurities are extracted or separated from white sugar, and the latter is isolated.

Hence the terms, white sugar and refined sugar, have grown to be synonymous; and the idea has been created that white sugar must necessarily be the product of a second operation. This notion is most fallacious, and not more fallacious than injurious, by causing the impression that no such body as white sugar could be primarily extracted from the cane or other sugar containing juice.

Very frequently do we hear the colonial sugar-growers subjected to many and adverse remarks because they have not, as it has been asserted, developed their art with the rapidity that modern scientific aids would have enabled them to do.

Much of this animadversion is unjust, for not only until the passing of Sir Robert Peel's Sugar Bill, in 1843, was the colonial sugar-producer not encouraged to make a product beyond a certain limit of goodness, but he was not permitted to do so, every step he took in this direction being checked by a high protective duty, with the object of favouring the home refineries.

Immediately the sugar duties were readjusted, the intelligent colonial sugar-growers availed themselves of the opportunity to improve their staple; but, unfortunately, they began with machinery instead of chemistry. They relied on improved means of boiling, not having yet procured the proper liquid to be boiled. Whilst their new experiments were being prosecuted, whilst they were bearing most stoically their present losses, and looking forward to a brighter future, England became deluged with finer sugars of Cuba and Brazil, made by the claying operation. The West India sugar-grower was undersold, and too frequently ruined. Often do we hear the question put—wherefore the West India sugar-grower does not practise the claying process? The question manifests little acquaintance with the subject at issue. The process of claying, be it remembered, is not indicative of an improved sugar manufacture, as is commonly supposed, but merely indicative of the fact that, at the expense of time, of labour, and a third of the material operated on, it has been deemed expedient to accomplish the washing out a certain amount of impurities from muscovado sugar. These facts being well considered as premises, the conclusion may very safely be arrived at that the claying operation can only be remuneratively practised under one of the following conditions—either in communities where slavery prevails, or where the price of labour (as in India) falls under the usual average.*

But to return to the subject of sugar-refining.

In commencing the study of this manufacturing operation, it will be useful to consider the theoretical indications to be followed out.

The substance to be operated upon is raw sugar; and the object to be kept in view is to extract the maximum of impurities, with the minimum of expense and of loss.

It has been already remarked that, if muscovado or yellow sugar were contaminated by chemical or soluble impurities only, the processes of claying and liquoring would effectually remove them. This, however, is far from the case. If a portion of the purest colonial sugar (made without animal charcoal) be dissolved in water, the presence of mechanical or floating impurities will be very manifest. Such impurities must be got rid of at any cost before the sugar can be refined. The most obvious way of accomplishing this removal would seem to consist in mechanical filtration through fibrous textures, followed by evaporation, and this succeeded by the processes of claying and liquoring.

It happens, however, that even were this process the most desirable, as well as the most obvious, yet the filtration of such sugar in thick solution is no very easy matter, on account of the glutinous nature of the chemical coloured impurities, as the experimenter may prove by means of a filter of paper; however, by allowing sufficient time, the thing, as an experiment, may be done; and I will suppose it done, for the sake of the next demonstration.

The liquor, when so filtered, if placed between the eye and a ray of light will be found to be entirely free from the mechanical impurities formerly visible, but will be dark from the presence of chemical impurities as before filtration; the indication, therefore, is obviously to reduce those chemical impurities by means of some combination to a mechanical or filtrable condition. The usual agent employed for this purpose in refineries is an aqueous solution of lime, that is to say, lime-water.

If a portion of the dark filtered solution be mixed with a portion of lime-water in a test-tube, and heated by a spirit-lamp flame, a manifest change will be observed. A portion of the soluble impurities will be found to become insoluble, assuming the condition of brownish flakes, and rendering the solution turbid.

The liquor now will be found to pass much more readily through a paper filter than before, and, moreover, will have been considerably lightened as to colour.

If the filtration process be conducted with less care, the liquor as it passes through will be contaminated with a portion of the separated impurities, which, in point of fact, are so delicate in their physical nature that the slightest force breaks them up and partially redissolves them,—a circumstance which, as may be imagined, would materially impede the filtering operation on a large scale. However, for the purpose of demonstration it can be, and sometimes is, accomplished.

If a little white of egg and lime-water be mixed with a portion of the solution while cold, and the mixture now heated in another test-tube, the same kind of result will be accomplished as in the last experiment, but with this addition, the albumen of the white of egg, or the blood during coagulation, envelops each floating particle of the mechanical impurity developed by the agency of lime, and brings it to the surface of the liquor in the form of scum, leaving the subnatant fluid clear and bright.

If the result of the last experiment be filtered a fluid will come through red, if blood has been employed; yellowish or amber, if the white of egg. Either of these solutions, on being evaporated, evolves an animal smell, and eventually yields crystals, from which the non-crystalline portion may be drained, and the crystals rendered white, by the process of claying (real or virtual), either alone, or the latter succeeded by the process of liquoring.

If, instead of evaporating the liquid immediately after passing through the filter, it be made to percolate through granular boneblack, the result is marvellously improved. Every trace of colour is dissipated, and the liquor feels less glutinous to the touch; it has acquired also (owing to the removal of impurities) an increased facility of crystallization. The smell of the animal matter, however, generally remains.

Having gone through these preliminaries, we are now in a position to contemplate the process of refining as now prosecuted.

A good refinery should consist of not less than four floors—if more, all the better. Its walls should be strong, its planks well-seasoned and close; and steam-pipes should be laid on throughout, so that a temperature of 80° can be easily commanded everywhere except on the ground floor, or fill-house, the bastard curing-room, and the stove, the former of which will require a temperature of 112° and the latter of 112° to 115° Fahr.

Through the middle of each floor is a large square hole, capable of being shut by means of a trapdoor, and through which the sugar is pulled from the lowest floor to the highest by means of a gin or small crane.

This is the best arrangement for a refinery, although the details of arrangement may vary considerably. The conditions which I have laid down are adapted to the supposition that the sugar is dissolved on the highest floor, and that it is subsequently worked down to the lowest, where, having been boiled, it is filled into moulds. These conditions are the most natural and the most rational; but they are sometimes violated, the sugar being dissolved on one of the lowest floors, and, subsequently, lifted again. By this latter method of procedure the height of a floor or story can be saved; but the operation of pumping is usually involved—an operation which is never to be recommended.*

Another floor or story in refineries is frequently saved by a less objectionable plan; the liquor prepared for boiling being discharged on the ground floor, and sucked up into the vacuum-pan on the second.

Wherever in a refinery the process be commenced, the first operation consists in effecting the solution of sugar, in such a mixture of water, lime-water, and blood, technically called spice, that the resulting liquor, at the temperature of 212° Fahr., shall have a specific gravity, by preference, of about 1.241, equivalent to 28° of Beaumé's saccharometer. This operation, which is called blowing up, is thus performed:—

The blow-up pan is a square or rectangular painted iron, or, much better, plain copper, tank, supplied with a perforated false bottom, under which is laid, horizontally, a three-armed tubular perforated pipe of copper, in connection with a steam-main. The use of this arrangement will be presently obvious. The sugar being put into the pan along with the predetermined quantity of blood, lime-water, and water, the quantities of each being adjusted by no fixed rule, the blow-up man lets on his current of steam, which, penetrating into the arms of the trifid horizontal pipe, emerges, in sharp jets, through the small apertures of the latter, and heats the contents of the blow-up pan with great rapidity to the boiling temperature. For this blow-up operation some houses use high-pressure steam, some low-pressure. There is now a prevailing opinion in favour of the latter, in consequence of a belief that high-pressure steam is destructive of sugar. Mr. Pontifex† now prepares a solution-pan similar in construction to the heater, *i.e.*, the necessary heat is imparted by means of a steam-jacket, thus avoiding the escape of any steam into the solution. This gentleman informs me that the advantages attendant upon the use of this form of pan is very great, a perceptibly larger amount of product, of better quality, being the result. That the injection of high-pressure steam into sugar solutions is destructive is rendered highly probable by the investigations of M. Violette, who has proved that wood may be carbonized by means of steam of only 6lb. pressure to the inch. (See *Journ. de Chim. et de Physique*, 1848.)

The result of boiling the contents of the blow-up pan will have been anticipated from a consideration of the experiment I have supposed to have been performed in a test-tube. A thick, bulky, offensive scum arises to the surface of the liquid, which might be skimmed off with tole-

* This remark only refers to the actual use of clay, not to the operation termed claying in refineries.

* Liquor can be raised by the pressure of steam much better than by the more common operation of pumping.

† The Messrs. Shears, of Bankside, have since borne testimony to the same effect.

rable facility, and the subnatant liquor left in a state approaching to mechanical purity. This skimming, however, is never praetised in the present day, filtration being had rccourse to, as a much more efficacious plan.

The process of filtration now universally adopted is the bag-filtration system, as it is called, and which offers the advantagc of a very large surface, comprehended within a very small space.

The bag-filter consists of a sack, about 5½ feet long, made of twilled cotton, prepared for this specific use. When to be employed it is used as follows:—The bag itself, which is about two feet broad, is squeezed loosely into a smaller bag (open at the bottom) made of very eoarse material, and technically known as the sheath. By this arrangement the whole filtering area of the bag is effective, although it is made to occupy very small dimensions. Each bag, with its aceompanying sheath, is tied by the following device to a brass nozzle slightly expanding at one end, to which the bag is affixed, and having a screw turned at the other end. The mouth of the bag, along with its sheath, having been brought well over the bell of the brass nozzle, is tied, sheath and all, moderately tight by means of strong cord. As it would be next to impossible, however, to whip the cord suffieiently tight to prevent the bag slipping off on a weight of sugar being poured into it, the following plan of tightening it is had recourse to:—A small copper bar of about four inches in length, being pushed under the cord, is twisted round until the necessary degree of tightness has been effected. The bar is now kept in position, and the twist prevented from returning by means of a second turn of cord. Many of these bags, usually about thirty-six, are hung in one series, as will be presently described, of which series there must be two.

A cast-iron tray, perforated with the requisite number of screw-holes to correspond with the number of bell-nozzles, is made to form the upper part or roof of a wrought-iron ehest supplied with doors, removable at pleasure, and rendered air-tight in their frames during filtration by means of tow and red lead made into a pad, which engineers call *a gaskin*.

At the inferior part of this chest are two exit-cocks; one supplied with a pipe that eonducts the filtered fluid away, and the other, technically called the foul-liquor cock, through which a portion of the filtered liquor may be examined from time to time.

One other orifice has to be mentioned—it is for the purpose of admitting steam, in an atmosphere of which the filter-bags are caused to remain during the whole period that filtration goes on. This is for the purpose of enabling the liquor to maintain its temperature, therefore to remain liquid, and hence to pass through readily.

The filter-chest and its accessories having been thus described, the operation of bag-filtration will be readily understood. The let-off cock at the blow-up pan being turned, the blow-up liquor necessarily runs into the trays forming the roof of the filter-chest, thence into the bag-filters, and from them into the lower part of the chest. The few first buckets full of liquor which pass are always turbid. The liquor is, therefore, allowed to flow away through the foul-liquor cock until a portion, being examined in a wine-glass or phial by the transmitted light of a candle or lamp, appears quite bright.

This period having arrived, the whole mass of liquor is allowed to run on to the charcoal filter, or cistern, as it is more generally called. These charcoal filters, or eisterns, are of various shapes, and made of various materials. The usual material is iron, and the usual shape that of a eylinder of about sixteen feet high, or more, by eight feet in diameter. Interiorly the cylinder is supplied with a false and perforated bottom on which is laid a piece of woollen. If made of iron the cylinder should be internally well painted with two coats of white lead on one of red. Copper is the preferable metal, but few refiners will encounter the expense of using it for charcoal cisterns.

Instead of the deep charcoal cistern just described, some manufacturers employ shallow tanks of iron or lead. The only advantage which these shallow tanks present over deep cisterns is, that they are better adapted to low buildings, and do not involve any perforation of the floors. Unquestionably the decolorizing effect of charcoal is best exercised by the use of deep cisterns.

Whatever the form of the charcoal cisterns, they should never be made or lined with lead, inasmuch as a crust of carbonate of the metal becomes formed, and no sooner formed than dissolved in the sugar solution, where it may be generally found if sought for. In this way I discovered, in the first day's liquor of one of the largest London refineries, a considerable amount of lead.

I do not advert to this subject with the object of proving that the amount of lead present in the solution would have exereised any perceptibly noxious effect on the health, or any perceptible destructive ageney on the sugar; but to record the fact of its presence, and thus to guard future experimenters from referring the origin of such lead to any specific process of refining in which the aceiates of lead have been employed, and from which they have been totally separated.

The process of conducting filtrations through boneblack, although remarkably simple in theory, yet requires some amount of practice to ensure the maximum of success. The principal results to be aimed at are, to accomplish the maximum rapidity of percolation, with the minimum of colouring matter left in the filtered liquor.

This due rapidity of percolation is sometimes regulated by the exit-cock under the false bottom of the charcoal cistern; in which case the upper part of the cistern, above the margin of the charcoal, serves the purpose of a tank of reception for the whole bulk of the liquor which has come away from the bag-filters. In other establishments the charcoal cistern is supplied with a cover perforated with two holes, through one of which the liquor is allowed to enter, through the other a jet of steam; which latter is said to prevent fermentation, and to impart to the charcoal that amount of temperature most conducive to the desired decolorizing effect. In any case the outside of the cistern should be protected against cooling influences by a coating of felt and easing of wood.

In allowing the liquor as it comes from the bag-filter to run on to the charcoal, care should always be taken to prevent the surface of the charcoal from being much disturbed. This object is usually attained by allowing the stream to impinge on some hard body laid upon the charcoal; a piece of broken pot or a brick tile is commonly used.

Whether the liquor be allowed to run on to the charcoal gradually, or whether it be poured on at once, the surface of the charcoal should never be suffered to become dry. This neglect would infallibly cause the resulting filtrate—or filtrated liquor—to be turbid; or, as the refiners say, milky.

If deep cisterns be used the liquor need not be caused to linger in the charcoal, by turning off the exit-cock, or otherwise; the first produce of filtration being usually perfectly decolorized and bright. Wherever shallow tanks are employed, however, the charcoal must be allowed to soak or digest with the liquid for a considerable time before the latter is fit to draw off.

It is said, in general terms, that one ton of boneblack, well burned, is eapable of perfectly decolorizing three of sugar. But this remark must neeessarily be vague, and open to modifications, due to the influenee of many collateral circumstances, as the reader will easily recognise. It must not be imagined, however, that the refiner unpacks his charcoal so soon as it ceases to effect the perfect deprivation of all colour. He allows it, in point of faet, to remain until the last portions of filtered liquor, instead of being colourless, are considerably darker than dark sherry.

The refiner, however, manages in this way. He commences his refine* by using newly-burned charcoal and good sugars; he then goes on using sugars more and more impure until the end of the third or fourth day, distingushing his liquor as first day's, second day's, and third day's liquor, &c.; from each of which, respectively, are prepared sugars of corresponding quality.

In order to judge of the mechanical purity of liquor from the charcoal cisterns, it is submitted to a very rigorous optical test: a wine-glass or small phial full being collected is held between the flame of a candle and the eye; when the slightest speck of mechanical impurity is perceptible, and is considered improper. If these mechanical impurities exist beyond a certain amount the result is a cloudiness or opalescence, and the sugar produced from such liquors will be generally of greyish cast. As regards ehemical impurities, they are very seldom sought after by refiners, who entertain the most fallacious notion that boneblack filtration is competent to remove all bodies of whatever kind, except sugar and water. The opinion is in nothing more unfounded than in respect to lime, a body which refiners imagine to be most especially removed by the charcoal-filtering operation. The fact, however, is, that lime, both combined and in the caustic form, may be generally, if not invariably, detected by means of the apropriate tests; and, if the blow-up pan be of iron, or if the painted internal coating of the iron charcoal cistern be abraded, distinct traces of this metal will also be diseoverable. Indeed, refiners often suffer from the existence of iron oxide in their sugars, to which red streaks or spots are thus imparted.†

I will now assume a sufficient quantity of liquor to have eome away from the eharcoal, to admit of the operations of vacuum-boiling. The let-off cock of the charcoal cistern I will assume to communicate with a tank placed above the level of the vacuum-pan, so that the liquor eontained in the tank shall fall into the measure, and thence into the vacuum-pan, by the force of gravity.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LII.

(LECTURE LXXX.)

TANNIN.

Section I.—SUBSTANCES WHICH OWE THEIR PROPERTIES EXCLUSIVELY TO THE TANNIN WHICH THEY CONTAIN—(*Continued*).

3. ROOTS CHARGED WITH TANNIN.

Several of the astringent roots employed in medicine are furnished by the family of the Rosaceæ.

The astringent property is most strongly developed in the Dryadeæ.

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* A refine is the series of conseeutive solutions, or *blows up*, upon which one charcoal-filter system is made to act.

† More than one patent has been taken out for the use of iron salts as agents to defecate or purify sugars; and iron preparations have been lately tried in the house of Messrs. Farrie, but with invariable want of success. Terry's patent, involving the use of prussiate of potash and sulphuric acid, and thus liberating a cyanogen salt of potassium (the ferro-sesqui-cyanuret of potassium of iron), was tried in the house of Messrs. M'Fie, of Liverpool, and, I am assured by one of the firm, with the result of colouring the goods—in this case *blue*—owing to the reaction of the undecomposed prussiate on a portion of liberated iron oxide.

The root of Tormentilla erecta is one of our most energetic indigenous astringents.

The roots of Potentilla anserina, Potentilla reptans, Geum urbanum, Geum rivale, and Geum canadense, enjoy considerable reputation as tonics; the tonic properties of these roots are owing simply to the tannin which they contain. The farinaceous tubers of Spiræa filipendula have an analogous astringent taste.

The diuretic properties of the roots of Fragaria vesca are attributable to the presence of a small quantity of tannin. These roots are used in infusions at the dose of 20 grammes per quart of boiling water.

The root of sorrel (Rumex acetosa) also possesses astringent and diuretic properties.

The root of snakeweed (Polygonum bistorta), which belongs to the same family as the sorrel, is much more energetic in its action than the latter. It contains tannin, gallic acid, and starch. It is a powerful astringent and tonic.

The snakeweed-root is given mostly in the form of ptisan or extract; it is also used to prepare astringent injections. The application of boiling water to the root must be carefully avoided, since this would dissolve the starch which would subsequently form an insoluble precipitate with the tannin.

RATANHIA.

Ratanhia is the root of Krameria triandra.

According to the analyses of Gmelin, Vogel, Peschier, and Trommsdorf, ratanhia contains:—

Tannin,
Extractive,
Insoluble apothema,
Gum,
Starch,
Mucous matter,
Several salts,
An acid which has not been sufficiently examined as yet.

The proportion of starch is very small only. In the samples of ratanhia which were analyzed by Gmelin no starch was found.

The astringent principles abound much more in the bark than in the woody part of the root.

POWDER OF RATANHIA.

This is a bad preparation, as the root contains a large proportion of inert matter. The root is very hard and tough, and is pulverized with great difficulty only. Moreover, the ratanhia roots of commerce vary greatly in composition, particularly as regards the astringent principles, and the powder is accordingly a most uncertain preparation.

PTISAN OF RATANHIA.

Take of Ratanhia-root, 8 to 32 grammes.
Water, 1,000 grammes.

The ptisan of ratanhia-root is usually prepared by decoction. The product has a deep red colour, and becomes slightly turbid upon cooling, owing to the separation of a portion of tannin apothema, and—in cases where the root is amylaceous—of a compound of tannin and starch, insoluble at a temperature below 122° Fahrenheit.

The process of infusion gives a greatly superior product. The infusion of ratanhia has a reddish-yellow colour, and appears, indeed, less charged than the decoction; but it possesses to a far higher degree the astringent taste of the root. By the protracted action of boiling water upon the root, part of the tannin is decomposed; or, rather—which is the more probable supposition of the two—a sparingly soluble compound is formed by part of the tannin with the vegetable fibre and a portion of the apothema. The addition of mineral acids to aqueous solutions of ratanhia—no matter whether prepared by decoction or by infusion—is to be avoided, as these acids form with the tannin sparingly soluble compounds.

EXTRACT OF RATANHIA.

Take of Ratanhia-root, any quantity you like.
Water, at 68° F., a sufficiency.

Reduce the root to powder, and moisten this with one half its weight of water; pile the moistened powder rather closely in the lixiviation apparatus, and lixiviate, taking care to stop the operation as soon as the appearance of the product indicates the approaching exhaustion of the root. Evaporate the liquors, at the heat of the water-bath, to the consistence of an extract.

Formerly the alcoholic extract of ratanhia was preferred to the aqueous extract prepared by lixiviation. The alcoholic extract contains, however, besides the astringent matter, a very large proportion of insoluble apothema, and is accordingly only very imperfectly soluble in water.

I have found sometimes as much as 40 per cent. of insoluble apothema in the alcoholic extract, whereas I have never found more than 10 per cent. in the aqueous extract. The latter, moreover, is very soluble in water. I have obtained from equal quantities of the same sample of ratanhia-root, with water 70 grammes, with alcohol of 56 Cent. 120 grammes, of extract.

SYRUP OF RATANHIA.

Take of Extract of ratanhia, 1 part.
Simple syrup, 30 parts.
Distilled water, 8 parts.

Dissolve the extract in the water, filter the solution, add the filtrate to the boiling syrup, and boil the mixture to 30°.

Thirty grammes of this syrup contain one gramme of extract.

TINCTURE OF RATANHIA.

Take of Ratanhia-root, 1 part.
Alcohol of 56 Cent. (21° Cartier), 5 parts.

Let the root macerate in the alcohol for eighteen days; strain.

Alcohol of 56 Cent. dissolves all the active principles of the ratanhia-root.

4. BARKS CHARGED WITH TANNIN.

The barks charged with tannin which are or may be employed in the arts and in medicine are very numerous. They are furnished by several very different families of plants. The most reputed of them are the barks of the Amentaceæ, to which family belong the common oak (Quercus robur), the birch-tree (Betula alba), and the alder (Betula alnus).

Among the Terebinthaceæ, the bark of Brucea antidysenterica, of Abyssinia, is renowned for its astringent properties. The barks of Rhus glabrum, Rhus typhinum, Schinnus terebinthifera, Spondias mangifera, and of the several species of the Comocladia, are used for tanning.

In the United States of North America the bark of Rhus cotinus and Rhus glabrum is used as a febrifuge.

Among the Rosaceæ, the barks of the several species of the genus Acacia are astringent. According to M. Saint-Hilaire, the bark of several acacia plants is used in Brazil to tan hides: this bark is called Barbatimao by the Brazilians. The barks of Acacia vera and Acacia arabica are employed for the same purpose. The bark of Acacia peregrina is used in New Granada as a tonic and febrifuge; and so are the barks of Acacia leucocephala, in Porto Rico; of Acacia ferruginea and of Œschinomene gradiflora, in the Indies; of Cassia hirsuta, in Brazil (this bark is called Fedegosa by the Brazilians). The Chinese attribute febrifuge properties to the roots of Cassia flava and Cassia amara; the same properties are attributed in East India to the roots of Cassia fistula and of Acacia tenuifolia.

The bark of the oak-tree and that of the root of the pomegranate-tree are about the only ones habitually employed in medicine.

BARK OF THE OAK-TREE.

The bark of the oak-tree (Quercus robur) is very astringent; its principal properties seem to be attributable to the tannin which it contains. It is employed chiefly as an astringent and styptic, both internally and in injections. It has been used also with greater or less success as a febrifuge; it appears that association with some bitter aromatic substance, such as gentian-root, for instance, tends to heighten the energy of its action.

According to Braconnot, the bark of the oak-tree contains:—

Tannin,
Gallic acid,
Uncrystallizable sugar,
Pectin,
Tannates of lime, magnesia, potass, &c.

According to Gerber, it contains, besides these principles, a matter similar to salicin.

The tannin of the bark of the oak-tree has not yet been examined in a state of purity. It seems to exist in the bark in association with gallic acid and some other substance. Braconnot found that the solution obtained by the action of water upon the bark of the oak-tree does not deposit an apothema upon evaporation, even though the processes of solution and evaporation be repeated several times; this is not the case with any other of the tanning substances. Braconnot remarked also the absence of corticin in oak bark.

POWDER OF OAK BARK.

For the purposes of the arts the bark is stripped off from branches twelve to fifteen years old, and ground in the mill to a coarse powder, which is usually called tan. This coarse powder may be used for the preparation of decoctions and infusions. But if it is intended to be used in the pulverulent form it must be reduced to a state of greater fineness, and sifted through a hair sieve. In this state it is called sometimes flowers of tan.

INJECTION OF TAN.

Take of Coarsely-powdered tan, 64 grammes.
Boiling water, 1,000 grammes.

Infuse.

POMEGRANATE.

Several parts of the pomegranate-tree (Punica granatum) are used in medicine. The still unfolded flowers, which are composed of a fleshy calix adhering to the ovary, are a good astringent, but hardly ever employed now. The calix which envelopes the fruits was formerly, and is still not unfrequently, used under the name of Malicorium.

This is an excellent astringent. In India and in the East it is used to expel intestinal worms, and more especially the tapeworm.

In Europe we employ chiefly the bark of the root, and the succulent and acid envelope of the seeds.

The bark of the root of the pomegranate-tree has been analyzed by M. Mitouart, and subsequently by M. Latour de Trie.

It contains:—

Tannin,
Gallic acid,
Resin,
Wax,
Fatty matter,
Mannite,

and, according to M. Landerer, a bitter crystalline matter, called by him Granatin.

The bark of the root of the pomegranate-tree is used as a specific against the tapeworm, particularly against the tænia armata, and also against the Taenia botryocephala.

The fresh bark is usually preferred, being considered more active than the dry bark. However, I have seen a great many cures effected by the latter, and feel inclined to think it equally efficacious with the former.

VERMIFUGE POTION.

Take of Fresh bark of pomegranate-root, 64 grammes.
Water, 750 grammes.

Boil down to a pint. Strain.

This potion is given in three doses. The evening before the patient must take 30 to 50 grammes of castor oil.

When the dry bark is used the dose is equally 64 grammes. The dry bark is macerated for twelve hours in cold water previous to the decoction.

EXTRACT OF BARK OF POMEGRANATE-ROOT.

Take of Dry bark of pomegranate-root, any quantity you like.

Take of Alcohol of 56 Cent. (21° Cartier), a sufficiency.

F.S.A.

This extract has been employed with success by M. Deslandes to expel the tapeworm.

DESLANDES' VERMIFUGE POTION.

Take of Linden-water,
Peppermint-water,
Lemon juice, of each 64 grammes.
Alcoholic extract of bark of pomegranate-root, 24 grammes.

F.S.A.

In some cases M. Deslandes employs the extract obtained by the successive action of water and alcohol upon the bark of the pomegranate-root.

MONESIA.

Monesia is the bark of Chrysophyllum glycyphyllum.

According to the analysis of MM. Henry and Bernard Derosnes, the monesia bark contains :—

Tannin, 7.5.
Monesia, 5.
Glycyrrhizin, 1.5.
Colouring matter analogous to the cinchona red, 9.
A little gum, pectic acid, fatty matters, and salts.

Monesia bears considerable analogy to saponin. It presents itself in the form of very friable, transparent plates. It dissolves very readily in alcohol and in water ; it is nearly insoluble in sulphuric acid. To water it imparts the property of frothing up. It has a bitter taste, speedily followed by a strong sensation of acridity in the throat.

Monesia bark has been successfully employed in affections characterized by general weakness of the system, and in cases of hemoptysis, diarrhœa, dysentery.

It is given mostly in the form of extract, at the dose of from 50 centigrammes to 1, 2, 3, and even 4 grammes per day.

EXTRACT OF MONESIA.

Take of Monesia, any quantity you like.

Treat the root with lukewarm water by the method of displacement, and evaporate the liquors to the consistence of an extract.

The root gives one fourth its own weight of extract.

TINCTURE OF MONESIA.

Take of Monesia, 1 part.
Alcohol of 56 Cent. (21° Cartier), 5 parts.

F.S.A.

SYRUP OF MONESIA.

Take of Extract of monesia,
Water, of each 1 part.
Simple syrup, 99 parts.

F.S.A.

POMATUM OF MONESIA.

Take of Extract of monesia,
Water, of each 1 part.
Sweet almond oil, 4 parts.
White wax, 2 parts.

F.S.A.

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5. LEAVES CHARGED WITH TANNIN.

The leaves of a great number of plants contain tannin, but few of them only are used in the arts or in medicine.

The leaves of Myrtus communis are employed for the tanning of hides ; the tops of Rhus coriaria (sumach) are extensively used by dyers, and so are the leaves of Rhus striatum in the United States, and those of Rhus metopium in the Antilles.

The leaves of some of the Rosaceæ are employed in medicine. The leaves of the several species of rose-trees, and more particularly the leaves of Rubus fructicosus (briar), and Agrimonia eupatorium, constitute frequently the basis of astringent gargles.

The leaves of Rubus arcticus, Dryas octopetala, Cerasus mahaleb, Rosa rubiginosa, are used in infusion as a kind of tea. These and the leaves of the whole family of the Drupaceæ often possess to a certain extent the smell and properties of bitter almonds.

The leaves of Arbutus uva ursi enjoyed formerly considerable reputation in diseases of the urinary organs.

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6. FLOWERS CHARGED WITH TANNIN.

The only flowers of this kind used in medicine (in Europe) are those of the Rosa gallica. The flowers of Brayera anthelmintica, of Abyssinia (known under the names cotz, cabotz, cusso, or cousso), are employed to destroy the tapeworm.

RED ROSES.

The petals of the red rose, or Rosa gallica, have been analzyed by M. Cartier. This chemist found in them :—

Essential oil,
Tannin,
Gallic acid,
Colouring matter,
Fatty matter,
Albumen,
Salts.

The red roses are used in medicine for the tannin which they contain, and which imparts to them tonic and astringent properties.

GATHERING AND DESICCATION OF THE FLOWERS.

The red roses should be gathered in the bud, since they are in that state more intensely coloured, and contain a larger proportion of astringent principles than they do in full bloom. The petals are separated from the calix, and dried on a hurdle in a well-aired loft. When dry they are sifted, and kept in close boxes.

POWDER OF RED ROSES.

Reduce the dried flowers to powder, without leaving a residue.

CONSERVE OF ROSES.

Take of Powder of red roses, 1 part.
Distilled rose-water, 2 parts.
Pounded sugar, 8 parts.

Mix the powder with the distilled water, and let it macerate for an hour or two. Add afterwards the sugar, and mix by trituration.

CONSERVE OF ROSES PREPARED WITH THE FRESH FLOWERS.

Take of Picked and cleansed petals of red roses, 1 part.
White sugar, 3 parts.

Pound the petals in a mortar together with their weight of sugar ; pass the pulp through the sieve, and add the rest of the sugar. Heat the mixture a few minutes in the water-bath.

The conserve prepared in this way has a fine colour ; but it ferments towards the latter months of the year, before the season at which a fresh supply of roses is obtainable. It is for this reason that the conserve prepared with the powder is preferred, which, though of a less pleasing aspect, affords this advantage, that it may be procured at all seasons.

The conserve of roses is employed at the dose of several grammes as a tonic, and more particularly as an astringent.

PTISAN OF RED ROSES.

Take of Dry flowers of red roses, 8 grammes.
Boiling water, 1,000 grammes.

Infuse for one hour, and strain.

SYRUP OF RED ROSES.

Take of Dry petals of red roses, 1 part.
Boiling water, 5 parts.
Sugar, a sufficiency.

Let the roses infuse in the water ; strain with expression ; filter the liquid ; add to the filtrate double its weight of sugar, and prepare a syrup by simple solution.

Instead of the dry petals fresh flowers may be used, altering the quantity from one part to three parts. The syrup prepared with the fresh flowers presents a finer colour than that prepared with the dry flowers ; but, on the other hand, it is less fragrant than the latter, as the process of desiccation tends to develop more strongly the odour of the red rose.

Thirty grammes of the syrup represent two grammes of red roses.

ROSE HONEY.

Take of Dry petals of red roses, 1 part.
Boiling water,
White honey, of each 6 parts.

Let the roses infuse in the water ; strain with expression ; mix the strained liquor with the honey, and boil to the consistence of syrup.

The method of displacement may also be had recourse to for the preparation of rose honey.

The operation is conducted as follows :—

Dry the roses in the stove, and reduce them subsequently to a coarse powder, by rubbing them on a metallic sieve with thirty meshes to the square inch. Shake this powder on a fine sieve to remove the stamina ; put it now in the water-bath, and moisten it with six parts of boiling water. At the end of half an hour put the species of paste obtained by this proceeding in a displacement apparatus, taking care to pile it very looscly. Cover it with a diaphragm, and lixiviate with boiling water. If the operation be well conducted, the roses will be exhausted when seven times their weight of liquid has been obtained.

Put the first liquors aside, and keep them for the final boiling of the honey.

In the common process (of the Codex) the residuary rose paste retains nearly the weight of the flowers of water ; one sixth of the infusion is accordingly lost. In the lixiviation process we may use one sixth part less of roses, and yet obtain as good and copious a product as the process of the Codex yields with the full quantity.

M. Deschamps recommends the following process :—Take 250 parts of roses, and treat them by lixiviation ; evaporate the product in the steam apparatus to 420 parts. Mix white filter paper with the rose liquor, add the honey, purificd previously by heat, in a covered water-bath, and strain.

I have adopted an analogous proceeding at the Central Pharmacy. I treat the coarse powder of red roses with a sufficiency of boiling water to yield, with the aid of a good press, the amount of liquid requisite to melt the honey. I add to the solution finely-divided filter paper, and keep it boiling for several hours in the water-bath ; the next morning I draw the product off with a syphon. This is the best process for the preparation of large quantities of rose honey ; all other processes tend more or less to impart a caramel taste and a brown coloration to the product. The rose honey of the Central Pharmacy is lighter coloured than that prepared according to the prescriptions of the Codex ; but the colour is pure, and the smell of the product very sweet.

The process of the Codex answers well enough for small quantities, but it bears no comparison to M. Deschamps' and mine, where large masses of liquid are to be evaporated.

Rose honey is used as a gentle astringent ; more particularly in the form of gargle, at the dose of 60 to 100 grammes.

ROSE WINE.

Take of Red roses, 1 part.
Red wine, 16 parts.

Macerate, strain with expression, and filter.

This wine is chiefly used externally and in injections to combat relaxation of the tissues.

ROSE VINEGAR.

Take of Dry petals of red roses, 1 part.
Red vinegar, 12 parts.

Macerate for eight days ; strain.

This vinegar is used in injections, and also for toilet purposes.

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7. FRUITS CHARGED WITH TANNIN.

Certain fruits containing an abundance of tannin are employed in the arts. These fruits are derived chiefly from the family of the leguminous plants. Among these fruits we may instance the *Bablah*, which appears to be furnished by the Acacia vera, A. arabica, A. cinerea, and, perhaps, some other species ; the *Algorobilla*, which is attributed to the Inga marthæ ; the *Dividive* or Liby-diby, which is attributed to the Cæsalpinia coriaria, of Carthagena. The fruits of the Acacia catechu furnish catechu.

The family of the Rosaceæ also furnishes some slightly astringent fruits. An astringent preserve is made, for instance, of the fruits of the sweetbriar (hips). The fruits of Cydonia vulgaris, Sorbus domestica, Malus communis, Pyrus communis, are also slightly astringent.

The only astringent fruit made use of for medicinal purposes is the acorn.

ACORNS.

Acorns contain, according to Lœvig's analysis, in 1,000 parts :—

Fatty oil, 43.
Resin, 52.
Gum, 64.
Tannin, 90.
Bitter extractive, 52.
Starch, 380.
Lignin, 316.
Salts of potass and of lime.

The decoction of acorns has been given sometimes with success in mucous diarrhœa; the natural association of the starch with tonic principles which we see in the acorn readily explains the beneficial action of the decoction of that fruit. But the usual way of administering acorns is in form of a species of coffee, *i.e.*, torrefied.

From 4 to 8 grammes of the torrefied and ground acorns are used per cup of boiling water. In this form the acorn is an excellent tonic and stomachic, and produces very beneficial effects in rickets, consumption, marasmus, and obstructions of the mesenterium.

According to M. Bourlet, acorns are used in Turkey as analeptics; they are kept buried in the ground for some time, to get rid of the bitterness; they are then dried, and subsequently torrefied and ground. The powder, mixed with sugar and spices, constitutes the *Palamoud* of the Turks and the *Racahout* of the Arabs. In this state it forms an article of food of very easy digestion.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

REMARKS UPON ALBUMEN, CASEIN, AND FIBRIN.

By M. F. BOPP.

When dilute hydrochloric acid is added to a mixture of milk and water in equal proportions, until the mixture separates into a bulky coagulum and a clear yellowish liquid, a precipitate is obtained which differs even in outward appearance from that produced in milk by acetic acid.

The liquid should now be filtered through a linen bag, and the precipitate collected in the latter. The precipitate should then be diffused through water acidulated with two to three per cent. of hydrochloric acid, and again collected by bag filtration; the same operation is to be repeated once or twice more. Upon washing the precipitate subsequently with water, to remove the acid adherent to it, it is observed to swell in proportion as the acid is washed away, and becomes speedily too gelatinous to permit the passage of water through its mass. But when mixed and stirred up with a sufficient quantity of water at about 104° Fahrenheit it dissolves.

The solution is found to retain still a considerable quantity of acid. This may be removed by precipitation with acids and alkalis, the latter of which, when added in excess, redissolve the precipitate to the formation of which their addition gives rise at first. Neither of the solutions possess the mucosity which is exhibited by milk or solution of common casein in carbonated alkalis, and which renders the separation of the casein from the fat a task of considerable difficulty.

The washings of the first precipitate run off slightly turbid: they hold casein in solution. Upon addition of hydrochloric acid to the solution a bulky precipitate subsides, perfectly analogous to the first. Now, it is well known that a precipitate that has been thrown down from solution of casein by acetic acid becomes compact in alcohol, whereas this precipitate (produced by hydrochloric acid), so far from becoming compact, swells up in alcohol, and even dissolves completely in a sufficient amount of that menstruum. Ether throws it down again from the alcoholic solution in white flakes, which swell in water, and subsequently dissolve in it. Carbonated alkalis also produce a precipitate in the original turbid solution; this precipitate, however, becomes compact in alcohol, although it dissolves subsequently likewise in an excess of that menstruum.

Schlossberger has recently published a paper in which he states that he has succeeded in separating casein into two distinct substances. This fancied separation of casein into two different principles is simply a mistake, which an attentive examination of the facts and data given above will enable the chemical reader to account for. Schlossberger added to the hydrochloric solution a small quantity of carbonate of ammonia, filtered, and added to the filtrate hydrochlorie acid, when he obtained a fresh precipitate. Now, it is hardly possible to add the exact quantity of alkaline carbonate required to precipitate the whole of the casein; there will always be added a little more or less. If the latter be the case, the acid, if the former, the alkali, will predominate; and in either case a precipitate will be obtained upon the subsequent addition of hydrochlorie acid.

Had Schlossberger repeated his experiment five or six times, he would have observed that the relative proportions of the two precipitates vary considerably. I examined and analyzed the two precipitates, viz., the one obtained by throwing down the whole of the casein from the hydrochloric solution by the addition of that acid in excess, and the other prepared according to Schlossberger's instructions, and I found them to be identically the same as regarded their composition. It is evident that casein forms two compounds with hydrochlorie acid, of which the one is insoluble; the removal of part of the acid by washing with water converts this insoluble into the soluble modification. The casein precipitated from the hydrochloric solution by means of an alkaline carbonate may be readily washed with water, and may in this manner be obtained almost entirely free from fat, without the use of either alcohol or ether. The two substances which Schlossberger was erroneously led to look upon as distinct and different bodies are readily convertible into each other, by precipitating the one in acid solution with an alkali, and the other in alkaline solution with an acid.

The following observations are simply meant to serve as the basis of more extensive investigations on the so-called protein compounds, which the author intends to enter upon at a not very distant period.

ACTION OF CAUSTIC ALKALIS UPON CASEIN, ALBUMEN, AND FIBRIN.

The most important products of the action of concentrated caustic alkalis upon casein are leucin and tyrosin. In a series of preliminary experiments I found that the action of potass upon casein differed in no striking point from that of the same alkali upon albumen and upon fibrin. The great difficulty in the way of obtaining the largest possible amount of leucin and tyrosin from casein by the action of potass lies in the circumstance that the two new products are liable to be decomposed by the prolonged action of potass; and this decomposition commences immediately after the full yield of leucin and tyrosin has been produced. The difficulty consists accordingly, here, simply in hitting the right time for arresting the reaction; and this end may be attained best by increasing the intensity and thereby shortening the duration of the latter. For this purpose take equal parts of dry hydrate of potass and dried and finely pulverized casein (albumen or fibrin); fuse the potass in its crystallization water in an iron vessel, and project the powder of the casein, &c., into it, replacing the water lost in the process by small additions from time to time, and stirring the mixture occasionally with an iron spatula. Violent effervescence ensues from the evolution of ammonia and hydrogen, which evolution is attended with the emission of a peculiar odour. The product of the full yield of leucin and tyrosin is indicated by a change of colour: the dark brown colour of the mixture changes to yellow. This is the only safe criterion. It requires some practice, however, to catch the right tint. The operator may to a certain extent be guided also by the time that the operation has lasted: this should never exceed half an hour. As soon as the peculiar tint makes its appearance, the operation must be stopped by the careful addition of water; the solution is then saturated with acetic acid, filtered, and left to cool.

[*To be continued.*]

ON COLUMBINE AND SOME OTHER SUBSTANCES DERIVED FROM THE MENISPERMEÆ.

By Dr. BÖDEKER.

Wittstock prepared columbine from Cocculus palmatus, De C. The author obtained it more readily and in a purer state by exhausting the columbo-root with spirit of 0.876 sp. gr., removing the spirit and rendering the residue as dry as possible. This residue is dissolved in water, and an equal volume of ether added, the two liquids frequently shaken, the separated ethereal solution removed with a syphon, filtered, and the greater portion of the ether separated by distillation. The aqueous solution of the columbo extract is treated repeatedly with ether until this dissolves scarcely anything further. The ether takes up, besides the columbine, a fatty oil, the greater portion of which remains dissolved in the little ether not distilled off. The greater portion of the columbine soon separates from this residue in a crystalline state. After pouring off the oily mother liquor, which still contains columbine, the crystalline mass is rinsed with cold ether, and then pressed between folds of bibulous paper. It has still a yellow colour, and must, for further purification, be dissolved in boiling ether containing neither alcohol nor water, and the ether distilled off to one fourth, when most of the columbine separates perfectly white, whilst the fat remains dissolved with the remainder of the columbine. It is difficult to remove this fat entirely from the columbine, which, however, succeeds by frequent recrystallization. The presence of fat may readily be detected on dissolving the columbine in acetic acid, when it floats in drops in the liquid.

The composition of columbine is represented by the atomic relations $C_{42}\,H_{22}\,O_{14}$. No combination of it could be obtained, on which account the formula with forty-two atoms of carbon was merely assumed for the reason that the same number is contained in the following substances procured from the columbo-root; and these, as will be subsequently shown, are closely related to each other:—Metallic salts do not precipitate columbine. Emulsine has no effect upon columbine mixed into a paste with water. An experiment to obtain a product of decomposition by fusion with aqueous potash, which might have thrown some light upon the composition, was not attended with success, for in the presence of a sufficient quantity of water the columbine is dissolved unaltered, whilst it is entirely decomposed when less water is present; in the latter case acids precipitate a brown humus-like substance from the aqueous solution of the fused mass. The numbers obtained by the author on analysis differ somewhat from those of Liebig, which is probably owing to the substance prepared by Wittstock, and analyzed by Liebig, having been less perfectly separated from the fat. The analysis gave :—

Carbon ..	65.11	65.29	42 =	3155.04	65.33
Hydrogen .	5.95	6.01	22 =	274.56	5.68
Oxygen ..	28.94	28.70	14 =	1400.00	29.09

Berberine, $C_{42}\,H_{18}\,NO_9$.—This substance was discovered by Fleitmann in the root of the

columbo. The dry spirituous extract of columbo, exhausted with hot lime-water, furnishes a deep brown-red solution, which, on saturation with muriatic acid, deposits an almost wholly amorphous substance mixed with a few yellow crystalline particles. After filtration an excess of muriatic acid is added, when, in the course of a few days, an abundant crystalline deposit is formed. The mass, which still has an acid reaction, is dissolved in alcohol of 0.850, again precipitated, and washed with ether. In this manner the berberine was obtained in the form of a beautiful bright yellow powder, which, under the microscope, presented the appearance of a confused aggregation of crystals. The aqueous solution, which was not acid, indicated the presence of a considerable amount of chlorine; gave with tannin chloride of platinum, perchloride of mercury, chlorate and chromate of potash, amorphous yellow precipitates; muriatic, nitric, and sulphuric acid, on the other hand, furnished crystalline deposits of different forms, which, however, all possessed the properties assigned by Fleitmann to the muriate of berberine. The author's analysis of the muriate of berberine from columbo-root likewise agrees with that of the muriate of berberine, $C_{42}H_{18}NO_9$, HCl, HO, from the barberry by Fleitmann:—

		Fleitmann.	Bödeker.
Carbon	.....	62.89	62.53	62.78
Hydrogen	....	5.44	5.67	5.07
Chlorine	....	9.13	8.80	9.06

According to the observations of the author, berberine furnishes quinoline on distillation with milk of lime and the hydrated oxide of lead.

The occurrence of this substance in Berberis and Cocculus is remarkable in a physiological point of view. Bartling places both these families, the Menispermeæ and Berberidæ, in the class of the Cocculinæ, which is in accordance with the fact of both containing the same principle. The columbine occurs in the cells of the root in the crystalline state; the berberine, on the contrary, is deposited in the yellow thickening layers of the cell-membranes mixed with a fatty substance, which protects it from the solvent action of the alcohol when the root is treated with this agent. Berberine occurs in Berberis vulgaris in precisely the same manner, except that it is deposited more abudantly and in a purer state. All the cells, and especially the vessels and woody cells, exhibit broad golden-yellow thickening layers, in which the berberine is very easily detected under the microscope; for on mixing a drop of muriatic, sulphuric, or nitric acid with a drop of absolute alcohol with which the root has been treated, the corresponding salt of berberine immediately begins to crystallize upon the slip of glass. The author draws especial attention to the circumstance that the berberine is found in cells, and not in peculiar organs of secretion. That it does not exist in the free state in the columbo-root is evident from the properties of the yellow crystalline masses which separate with the columbine from an inspissated alcoholic extract. The neutral reaction, and in comparison with berberine less solublity in water and lighter golden-yellow colour, sufficiently prove it to be a salt of berberine. Acids separate from its solution in water, and still better in lime-water, columbic acid; whilst but relatively very small quantities of potash are contained in the form of chloride of potassium and nitre in these impure deposits; consequently the berberine can only be contained in the thickening layers of the cells of the columbo as columbate of berberine. It appears to exist in a different form in Berberis according to the author.

Columbic Acid, $C_{42}H_{23}O_{13}$ (dried at 239°).—The solution obtained on digesting the dried alcoholic extract of columbo with lime-water, and the turbid aqueous solution of the spirituous extract of columbo, deposit on the first addition of acids, before the separation of any berberine salt, more or less purely amorphous yellow precipitates. They are washed with water to remove any salt of berberine. By exhaustion with boiling ether the columbine is removed, upon which it is dissolved in dilute caustic potash, and carbonic acid passed into the solution, which precipitates a dark brown flocculent substance. A slight excess of muriatic acid now throws down a copious white flocculent precipitate, which during the washing upon the filter condenses into a pale straw-coloured powder without any signs of crystallization. The acid thus obtained burns with flame when heated upon platinum foil, leaving no residue; it was free from muriatic acid, and had a strong acid reaction upon moist litmus paper. Its taste is bitter, like that of columbine, but less so. It dissolves but sparingly in cold ether, scarcely at all in water, more readily in acetic acid, but best of all in alcohol, with a light yellow colour. Cold nitric acid has no action upon it; even concentrated sulphuric acid dissolves the substance apparently unaltered at a gentle heat; upon the addition of water it appears to be thrown down unaltered; it readily dissolves in dilute caustic potash with a light brownish-yellow colour. Its alcoholic solution is not precipitated by acetate of copper; with an alcoholic solution of acetate of lead it furnishes a copious yellow precipitate. From all the solutions in alcohol, ether, and acetic acid, the columbic acid was constantly obtained in the form of a yellow varnish-like residue.

The pure acid and a basic lead compound (the precipitate produced by an alcoholic solution of acetate of lead in the alcoholic solution of the acid) were employed to determine the composition. The lead salt, after being dried at 212°, lost up to 266° 4.29 per cent. of water. The salt dried at 212° contained 30.19 per cent. oxide of lead. The acid dried at 104°, heated to 239°, lost 5.04 per cent., of which, however, half was expelled at 212°. The acid dried at 239° gave:—

Carbon	66.64	42=3155.04	66.54
Hydrogen	6.29	23= 287.04	6.05
Oxygen	27.07	13=1300.00	27.41

We have, therefore:—

Anhydrous acid in lead salt dried at 266° .. $= C_{42}H_{21}O_{11} = \overline{Col.}$

Acid dried at 104° .... $= C_{42}H_{21}O_{11} + HO + 3aq.$

Acid dried at 212° .... $= C_{42}H_{21}O_{11} + HO + 2aq.$

Acid dried at 239..... $= C_{42}H_{21}O_{11} + HO + aq.$

The analogy of these three substances occurring in the columbo-root, with three others also contained in a Menispermeaceous plant, the Anamyrta cocculus, is remarkable. We have, on the one hand, columbine, columbic acid, and berberine, and, on the other, picrotoxine, cocculinic acid (subpicrotoxic acid), and menispermine. The latter basic substance occurs, according to Peltier and Couerbe, with the acid in the highly vascular shells, whilst the neutral picrotoxine is deposited in the inner parenchyma of the kernel, which is nearly destitute of vessels. According to the author, exactly the same occurs in the columbo-root; the base and the acid are found most abundantly in the thickening strata of the vessels and the adjacent cells, whilst the cells of that portion of the parenchymatous tissue in which no formation of vessels has yet commenced contain extremely little or no berberine, but are filled with neutral columbine. Now, it appears probable that columbine was likewise produced in the older cells (which subsequently become situated in the interior of the root, and are permeated by vessels), when they possessed the same relative position as those layers which at present contain columbine; hence it may be admitted that the neutral substance must be considered to be the relatively primary formation, which subsequently, with the development of the vascular tissue and the addition of ammonia as conjunct, became separated into an acid and a base. Even should we not be disposed to lay too much weight, for the present, on this view, it will serve to exhibit the formation and connection of the substances occurring in the columbo-root:—

2 equivs. columbine..	$C_{84}H_{44}O_{28}$	
1 " ammonia...	H_3 N	
	$C_{84}H_{47}O_{28}N$	
Berberine	$C_{42}H_{18}O_9$ N	
Col. + 8HO	$C_{42}H_{29}O_{19}$	
	$C_{84}H_{47}O_{28}N$	

The author has also prepared and analyzed the alkaloid pelosine, discovered by Wiggers in the root of an American Menispermea, Cissampelos Pareira, Lam. It was prepared according to the same method, and possessed the properties assigned to it by that chemist. The author at the same time analyzed some salts of Pelosine. According to his analysis, Pel = NH_3 ($C_{36}H_{18}O_6$):—

Carbon	71.94	72.08	36=2704.32	72.28
Hydrogen ..	7.22	7.04	21= 262.08	7.00
Nitrogen ...	..	..	1= 175.06	4.68
Oxygen	..	..	6= 600.00	16.94

Hydrate of Pelosine, $C_{36}H_{21}NO_6$, HO+2aq.—Whenever pelosine comes into contact with water or aqueous vapour it passes into the state of hydrate, which is insoluble in ether. Dried over sulphuric acid, it lost at 248° 8.21 per cent. of water:—

Pelosine....	91.79	1=3741.46	91.93
Water	8.21	3= 337.44	8.27

Muriate of Pelosine, $C_{36}H_{21}NO_6$, HCl+2HO (dried over sulphuric acid), is obtained when dry muriatic gas is passed into the clear solution of the pelosine dried at 248° in ether, which must be free from alcohol and water, until the solution has an acid reaction; the white flocculent precipitate is quickly collected on a filter, and washed with pure ether until this no longer reddens moist litmus paper. The filter with the precipitate is then immediately dried over concentrated sulphuric acid. It forms a pure white powder, which is readily soluble in water and alcohol; on evaporating these solutions it is left behind as a varnish; it quickly absorbs water, and thereby assumes, without becoming moist, a fused amber-like appearance. The muriate of pelosine lost, by drying at 230°, 4.95 and 5.13 per cent. of water, which, with the results of the analysis, leads to the formula above given. The salt dried at 230° gave:—

Carbon ..	63.65	63.92	36 =	2704.32	64.44
Hydrogen	6.58	6.60	22 =	274.56	6.54
Nitrogen..	4.08	..	1 =	175.06	4.17
Oxygen ...	14.61	..	6 =	600.00	14.29
Chlorine..	11.08	..	1 =	443.28	10.56

Chloride of Platinum and Pelosine, $C_{36}H_{21}NO_6HCl + PtCl_2$, obtained by precipitating an alcoholic solution of the pure muriate of pelosine with chloride of platinum, forms a pale yellow, perfectly amorphous, and highly electrical powder. After desiccation over sulphuric acid it lost no more water at 230°. It melts at a higher temperature, puffs up considerably, diffusing an extremely disagreeable odour resembling that of leucoline and carbolic acid. It gave on analysis:—

Carbon ..	43.53	..	36 =	2704.32	42.82
Hydrogen	4.88	..	22 =	274.56	4.35
Nitrogen	..	..	1 =	175.06	2.77
Oxygen..	..	..	6 =	600.00	9.50
Platinum	19.13	19.82	1 =	1232.08	19.50
Chlorine	..	..	3 =	1329.84	21.06

Chromate of Pelosine, $C_{36}H_{21}NO_6$, CrO_3+2HO.—Bichromate of potash produces in a solution of muriate of pelosine a lively yellow precipitate, which in the washing and drying loses its yellow colour and becomes dirty yellowish-brown; it grows darker even in the dry state under the air-pump. Heated to 176°, the salt becomes very dark brown; at a little above 212° the whole of the organic matter is rapidly destroyed, with evolution of leucoline and carbolic acid, leaving a mixture of a little carbon with oxide of chromium. This behaviour explains the difference between the calculated and the found results, although the salt employed for the analysis was dried over sulphuric acid:—

Carbon	59.07	..	36=2704.32	58.85
Hydrogen ..	5.55	..	23= 287.04	6.24
Nitrogen	..	..	1= 175.06	3.81
Oxygen	..	..	8= 800.00	17.41
Chromic acid	14.52	14.56	3= 628.87	13.69

Pelluteine, NH_3 ($C_{42}H_{18}O_7$).—The white pulverulent hydrate of pelosine acquires, under the

influence of the air, humidity, and light, a deep yellow colour, with disengagement of ammonia. After being boiled with water, in order to convert any unaltered hydrate of pelosine into this new substance, ether no longer dissolved it. The mass is dissolved in boiling absolute alcohol; a humus-like substance is left undissolved, and a light brownish-yellow mass is deposited from the solution in flakes, which were washed with cold alcohol and dried. The name of this substance is derived from Pelosinum and luteum. It exhibits towards reagents precisely the same behaviour as pelosine, from which it differs by its insolubility in ether and its colour. The substance dried at 230° gave :—

Carbon.....	73.99	42 =	3155.04	73.51
Hydrogen ..	6.18	21 =	262.08	6.18
Nitrogen	3.84	1 =	175.06	4.00
Oxygen	15.99	7 =	700.00	16.31

The muriate of pelluteinc furnishes with chloride of platinum a double salt, which was found to contain 17.84 per cent. platinum; according to this the atomic weight of pelluteine is 4331.87, and calculated according to the above formula 4292.18.

In conclusion, the author observes that the bebeerine prepared by Tilley and Maclagan from Nectandra Rhodiei possesses many properties in common with pelosine; an essential difference, however, is apparent in the products of decomposition of the platinum double salts by heat. The chloride of pelosine and platinum disengages an extremely disagreeable odour, resembling that of a mixture of leucoline and carbolic acid, whilst the chloride of bebeerine and platinum diffuses on its decomposition an agreeable odour like that of oil of bitter almonds; it likewise differs in composition, particularly in the amount of water.—*Liebig's Annalen*, lxix., p. 37.

City Sewers.—Guildhall.—The commissioners assembled on Tuesday, the 17th inst. Deputy Peacock presided. It was resolved by the committee that the New River Company should be written to to ascertain whether a continuous supply of water would be given in some of the densely-populated lanes of the City. Mr. Barber complained of a malting-house nuisance in Paternoster-row. The matter was referred to the solicitor of the court. A communication from the London unions on the application made by the Board of Health committee for leave to send a paid officer of city sewers to copy the information required by the medical officer from the books of the several unions was read. The answers of the guardians of the City and West London unions were in accordance with the wishes expressed. The answer of the East London union referred the board to the medical officer of the union. It was decided that the chairman should wait upon the board of guardians of the East London union to arrange the matter in a satisfactory manner. A letter from the City Gas Company was read, in which it was stated that, whatever the result of the bill might be, it would not influence the intention of the committee of management, who merely withheld the announcement of their determination for the present to prevent misapprehension on the part of the promoters of the bill, who had delayed its progress for six weeks, and but for which the committee of management would have been free to send in their answers on the 13th, according to promise. The letter was very unsatisfactory to the commissioners, who soon afterwards adjourned.

M. Berry, Middlesex, engineer, for certain improvements in the construction of printing machinery or presses. Patent dated Aptil 9th, 1835; expired April 9th, 1849.—(Communication.)

H. F. Bacon, Cambridge, for an improved apparatus for regulating the flow of gas through the pipes to gas-burners, with a view to uniformity of supply. Patent dated April 9th, 1835; expired April 9th, 1849.

ALLOYS, SOLDERS, AND AMALGAMS EMPLOYED IN THE ARTS.
By M. CHAUDET, ASSAYER OF THE MINT AT PARIS.

Alloy of gold coin (French standard)	gold	900	1000
	copper	100	
Alloy of silver coin (French standard)	silver	900	1000
	copper	100	
Alloy of "bullion" (French standard)	copper	800	1000
	silver	200	
Alloy of gold medals (French standard)	gold	916	1000
	copper	84	
Alloy of bronze medals	copper	92	100
	tin	8	
Alloy of jewellery (French standard)	gold	750	1000
	copper	250	
Alloy of silver plate (French standard)	silver	950	1000
	copper	50	
Alloy of gold coin (United States standard)	gold	899.22	1000
	copper and silver	100.78	
Alloy of silver coin (United States standard)	silver	892.43	1000
	copper	107.57	
Alloy of gold coin (English standard)	gold	916.67	1000
	copper and silver	83.33	
Alloy of silver coin (English standard)	silver	925	1000
	copper	75	
Alloy in imitation of gold	copper	91.00	100½
	tin	9.50	
Alloy in imitation of silver (*Chinese Packfoud*)	copper	61.27	106
	zinc	28.78	
	nickel	15.13	
	lead	82	
Alloy for cannon	copper	100	111
	tin	11	
Alloy for statues (*Keller*)	copper	91.40	100
	zinc	5.53	
	tin	1.70	
	lead	1.37	
Alloy for bronzes and candelabras	copper	82.00	104½
	lead	1.50	
	tin	3.00	
	zinc	18.00	
Alloy for the mounting of firearms	copper	80	100
	zinc	17	
	tin	3	
Alloy for cymbals, tom-toms, or Chinese gongs	copper	80	100
	tin	20	
Alloy for bells	copper	75	100
	tin	25	
Alloy for the reflectors of telescopes	copper	2	3
	tin	1	
Alloy for brass for the lathe	copper	65.80	100
	zinc	31.30	
	lead	2.15	
	tin	0.75	
Alloy of brass for the hammer (*Chaudet*)	copper	70.10	100
	zinc	29.90	
Alloy for type	lead	80	100
	antimony	20	
Alloy fusible in boiling water	bismuth	8	16
	lead	5	
	tin	3	
Alloy for plugging teeth	bismuth	8	17.6
	lead	5	
	tin	3	
	mercury	1.6	
Alloy for tinning iron	tin	8	9
	iron	1	
Alloy used to make ductile gold of 18 carats, 950 millièmes	copper	990	1000
	gold	10	
Alloy for bells of mantel-clocks	copper	75	100
	tin	25	
Alloy for the pivots of artificial teeth	platinum		
	silver		
Alloy for ditto, and philosophical instruments (*P. N. Johnson, London*)	palladium	50	100
	silver	50	
Alloy for the springs of artificial teeth, combining the elasticity of steel with the lightness and hardness of platinum (*P. N. Johnson, London*)	copper	50	160
	palladium	50	
	silver	50	
	iron	10	
Solder of gold of 750 or 18 carats	gold of 760	2.00	3
	copper	0.50	
	silver	0.50	
Solder of silver of 750	silver	2	3
	brass	1	

Solder for brass	copper	50	100
	zinc	50	
Solder for lead	lead	2	3
	tin	1	
Amalgam of gold for gilding on metal	mercury ..... 91 to	89	100
	gold ..... 9 to	11	
Amalgam of silver	mercury	85	100
	silver	15	
Amalgam for taking impressions of seals	copper		
	mercury		
Amalgam for silvering mirrors	tin	70	100
	mercury	30	
Amalgam for silvering globes of glass	mercury	80	100
	bismuth	20	
Amalgam for the cushions of electrical machines	mercury	2	4
	tin	1	
	zinc	1	

ON THE DIURNAL VARIATIONS OF THE MAGNET NEEDLE, AND ON AURORÆ BOREALES.

By AUGUSTE DE LA RIVE.

[*Being an Extract from a Letter to M. Arago.*]*

Allow me to communicate to you, with the request that you will make it known to the Académie des Sciences, an extract of a memoir recently read before our Société de Physique et d'Histoire Naturelle, on the cause of the diurnal variations of the magnet-needle and of auroræ boreales. In assigning successfully these two classes of phenomena to the same origin, I have but followed the path you have pointed out; for more than thirty years ago you established with indefatigable perseverance, by your numerous observations, the remarkable agreement which prevails between the appearances of the aurora borealis and the disturbance of the magnet-needle.

The following is my theory. You will observe that it rests solely upon well-ascertained facts and on principles of physics positively established.

I had already, in 1836, in a notice upon hail, attempted to show that the atmospheric electricity owes its origin to the unequal distribution of temperature in the strata of the atmosphere. It is well known that, in a body of any nature whatsoever heated at one of its extremities and cooled at the other, the positive electricity proceeds from the hot part to the cold, and the negative electricity in the contrary direction; it thence results that the lower extremity of an atmospheric column is constantly negative, and the upper one constantly positive. This difference of opposite electric conditions must be so much the greater the more considerable is the difference of temperature; consequently more marked in our latitudes in summer than in winter, more striking in general in the equatorial than in the polar regions. It must be observed that the negative state of the lower portions of the atmospheric columns must be communicated to the surface of the earth on which they repose, whilst the positive state of the upper portions is diffused more or less, from above downwards, through nearly the whole of each of the columns, according to the facilities offered by the greater or less degree of humidity of the air to the propagation of the electricity. An atmospheric column, therefore, resembles a high-pressure battery on account of the imperfect conductibility of the elements of which it is composed,—a battery, the negative pole of which is in constant and direct communication with the terrestrial globe, discharges itself upon the globe, whilst it becomes itself charged with the electricity of its positive pole, which is distributed over it with an intensity decreasing with the distance from this pole. This explains why the positive electricity increases with the height of the atmosphere.

The causes which determine the accumulation of negative electricity at the surface of the earth, and of positive electricity in the upper regions of the atmosphere, act in a continuous manner; there should thence result an unlimited tension of the two opposite electric states, if, having attained a certain degree of energy, they did not neutralize each other by the aid of different circumstances. In other words, having reached a certain limit of tension, which varies with the state of the atmosphere and the surface of the earth, the two electricities cannot go beyond it, and unite or neutralize each other as regards the excess over that limit. The neutralization is effected in two ways—in a normal or constant manner, and in an irregular and accidental manner.

This second mode is exhibited under a variety of forms; sometimes it is simply the humidity of the air, and, better still, the rain or snow, which re-establish the electrical equilibrium between the earth and the atmosphere; in some cases waterspouts manifest in an energetic form the mutual action of the two electricities, which tend to unite. Sometimes the winds, by mixing the air in contact with the surface of the earth, and like it negative, with the positive air of the more elevated regions, give rise to sheet lightning or to storms, when there is at the same time a formation of clouds and condensation of aqueous vapours, owing to the humidity and different temperature of the strata of air which become mixed. The attraction of clouds by mountains, the luminous phenomena exhibited at the extremity of elevated points, are likewise due to the same cause. But I will not stop to discuss further all these natural and intelligible consequences of the theory which I expound. I shall confine myself to one single remark, which is, that we must bear in mind that in observations of atmospheric electricity the intensity of the electric signs perceived is not always a proof of the intensity of the electricity itself; for the humidity of the atmosphere, by favouring the propagation of the electricity of the upper strata, may give rise, as is frequently seen in winter, to very powerful electrical manifestations even when the cause producing them is not very powerful. The contrary is frequently seen in summer.

I now pass to the regular and normal mode of neutralization of the two electricities. I had already suspected the existence of this mode in my notice of 1836; but I did not announce it positively, because there was then wanting a fact which science now possesses, viz., the perfect conductibility of the terrestrial globe with which the employment of the electric telegraph has made us acquainted.

To make it understood how I conceive this mode of neutralization, I divide the atmosphere into annular strata parallel with the equator; the positive electricity accumulated at the external portion of this layer cannot exceed a certain degree of tension without traversing rarefied and more or less humid air until it reaches the polar regions, where, finding an atmosphere saturated with humidity, it will combine readily with the negative electricity accumulated on the earth. We have thus the circuit formed; each annular stratum of the atmosphere gives rise to a current which proceeds in the elevated regions from the upper portion of the stratum towards the pole, redescends to the earth through the atmosphere surrounding the poles, and returns by the surface of the globe from the pole to the lower part of the stratum from which it started. These currents will consequently be the more numerous and the more concentrated the nearer we approach the pole; and, as they all proceed in the same direction, that is to say, from south to north in the upper portion of the atmosphere, and from north to south on the surface of the earth, their effect will become the more perceptible in proportion as we leave the equator and approach the pole. But as the currents produced by the equatorial strata are individually stronger than those proceeding from more northerly strata, the difference, although real, will notwithstanding be less than would be believed. What passes in our northern hemisphere must occur in exactly the same manner in the southern hemisphere; the currents proceed equally from the equator to the pole in the upper regions of the air, and from the pole to the equator on the surface of the earth; consequently, for an observer travelling from the north pole to the south, the current would proceed in the same direction from the northern pole to the equator, and in a contrary direction from the equator to the southern pole. I speak here of the current circulating on the surface of the earth. I ought, moreover, to observe that the limit which separates the regions occupied by each of these two great currents is not the equator properly so called, for it must be variable; it is, according to my theory, the parallel between the tropics which has the sun at its zenith; it changes consequently each day.

Now, it is easy to conceive the cause of the diurnal variations of the magnetic needle. In conformity with the laws established by Ampère, the current which proceeds from the northern pole to the equator ought to cause the north pole of the needle to deviate to the west, which is what takes place in our hemisphere; and the current which proceeds from the southern pole to the equator should cause the north pole of the needle to deviate to the east, which is precisely what occurs in the southern hemisphere. The deviation should be, in one and the same place, the more considerable the greater the difference of temperature, and consequently of the electric conditions between the lower and the upper stratum of the atmosphere; thus the deviation increases from the morning to 1h. 30m. p.m. It is more considerable in those months during which the sun is longer above the horizon; it is at its minimum in the winter months. Lastly, these diurnal variations increase in magnitude in proportion as we recede from the equator and approach the pole, a result which again perfectly agrees with what I have stated respecting the increase in number of the currents towards the polar regions. In these regions themselves the variations may be very irregular, and may be entirely absent if the magnetic needle happens to be placed in those very localities where the electric currents traverse the atmosphere to reach the earth; in fact, a needle surrounded thus on all sides by currents is no longer affected by them, or at least is no longer affected in a regular manner. This remark may explain certain observations, especially those made at Port Bowen, which appeared rather exceptional.

On examining carefully all the magnetic observations I was able to consult, and in particular those of Colonel Sabine, I was especially struck by the remarkable manner in which they agreed with my theory. I will cite but one example—the observations recently made at St. Helena, and just published, by Colonel Sabine. At St. Helena the diurnal variation occurs to the west as long as the sun is to the south of the island, and to the east as soon as the sun is to the north. In fact, in the first case, as I have previously observed, St. Helena must form part of the region in which the electric currents proceed on the surface of the earth from the

* From the "Annales de Chemie et de Physique" for March, 1849.—(*Phil. Mag.*)

north pole to the equatorial regions ; and, in the second case, it forms part of the region in which these currents pass from the south pole to the equator. The hour of the maximum of the diurnal variation is not the same at the island of St. Helena as in the continental countries, which is owing to the temperature of the surface of the ocean not following the same laws in its diurnal variations as the temperature of the surface of the earth. Now, the temperature of the lower stratum of the atmospheric column is always that of the surface of the ocean, or of the soil on which it rests. This same circumstance explains certain apparent anomalies exhibited by the diurnal variations in some parts of the globe, as, for instance, at the Cape of Good Hope, which is surrounded almost on every side by a vast extent of ocean.

I wish it to be understood that in the preceding I have only taken notice of the causes disturbing the direction of the magnetic needle, and not of the cause of this direction itself, that is to say of terrestrial magnetism, a cause which I do not at all believe to be of the same nature, but upon which I at present express no opinion. I am content to consider the terrestrial globe as a large spherical magnet, and to study the external causes capable of modifying the direction which it tends to impart in its quality of magnet to magnetic needles.

Now, what is the aurora borealis according to the theory which I have just expounded? It is the luminous effect of electric currents travelling in the high regions of the atmosphere towards the north pole, an effect due to the combination of certain conditions, which are not always exhibited in the same manner, nor at all seasons of the year.

It is now well proved that the aurora borealis is an atmospheric phenomenon, as you long ago suspected. The name of magnetic storm, by which Von Humboldt designates it in his "Cosmos," implies the same idea, which is moreover confirmed by the interesting details which he gives of this meteor. The observations of Parry, Franklin, and especially those of MM. Bravais and Lottin, so numerous and carefully made, are likewise quite favourable to this opinion, which followed equally from the observations of M. Biot at the Shetland Isles.

Admitting this point, I explain the production of the aurora borealis in the following manner :— When the sun, having passed into the southern hemisphere, no longer heats so much our hemisphere, the aqueous vapours which have accumulated during the summer in this part of the atmosphere begin to condense, the kind of humid cap enveloping the polar regions extends more and more, and facilitates the passage of the electricity accumulated in the upper portions of the air. But in these elevated regions, and especially at this period of the year, the aqueous vapours must most frequently pass into the state of minute particles of ice or snow floating in the air, similar to those which give rise to the halos ; they form, as it were, a kind of semitransparent mist. Now, these half-frozen fogs conduct the electricity to the surface of the earth near the pole, and are at the same time illumined by these currents or electric discharges. In fact, all observers agree in asserting that the aurora borealis is constantly preceded by a mist which rises from the pole, and the margins of which, less dense than the remainder, are coloured at first; and, indeed, it is very frequent near the pole in the winter months, and especially in those where there is abundance of vapour in the air. For it to be visible at great distances from the pole it is necessary that these clouds, composed of frozen particles, extend in an almost uninterrupted manner from the polar regions to somewhat southern latitudes, which must be of rare occurrence. These same clouds, when they are partial, which is frequently the case, produce the halos.

Now, the analogy pointed out by nearly all observers between the mists which accompany the aurora borealis and those which produce the halos is a somewhat remarkable circumstance. It is easy to verify by direct experiment the identity which exists between the light of the aurora borealis and that obtained by passing a series of electric discharges into rarefied air containing a large quantity of aqueous vapour, and especially through a very thin layer of snow or a slight layer of hoar frost deposited on the glass. I have ascertained that highly rarefied but perfectly dry air gives but a very faint light, and that in the experiment of the vacuum-tube it is essentially the moisture adhering to the inner sides of the tube which, by conducting the electric discharges, gives rise to the luminous effects. It will be conceived that the electric discharges transmitted by this kind of network of ice must, on becoming concentrated near the pole, produce there a far more brilliant light than they develop when they are distributed over a much greater extent.

But why does the magnetic pole, and not the terrestrial pole, appear to be the cause of the phenomenon? Here is my answer. Place the pole of a powerful electro-magnet beneath a large surface of mercury; let this surface communicate with the negative pole of a powerful battery ; bring near to it the point of a piece of charcoal communicating with the positive pole of the battery ; immediately the voltaic arc is formed, and the mercury is seen to become agitated above the electro-magnet ; and, wherever this is placed, luminous currents are observed to rotate around this pole and throw out, from time to time, some very brilliant rays. There is always, as in the case of the aurora borealis, a dark portion in the form of a circular point over the pole of the magnet ; this peculiar effect disappears without the voltaic light being interrupted when the electro-magnet ceases to be magnetized. With a continuous current of ordinary electricity arriving at the pole of a powerful electro-magnet in rarefied and moist air, luminous effects, still more similar in appearance to those of the aurora borealis, are obtained.

These phenomena result from the action of magnets on currents; now, the same should apply to the action of the magnetic pole of the earth ; the neutralization of the two electricities probably takes place over a somewhat large extent of the polar regions; but the action of the magnetic pole causes the conducting mists to rotate around it, sending forth those brilliant rays which by an effect of perspective appear to us to form the corona of the aurora. The sulphurous odour, and the noise which is said sometimes to accompany the appearance of the aurora, would not be inexplicable ; for the odour would be due, like that which accompanies lightning, to that modification which the passage of electric discharges produces upon the oxygen of the air which M. Schönbein has called ozone ; while, as regards the noise, it would be analogous to that which, as I have shown, the voltaic arc produces when it is under the influence of a very near magnet. If it seldom occurs in the case of the aurora, it is owing to its being very rare that the luminous arch is sufficiently near the earth, and consequently to the pole. However, the description which has been given of this noise by those who have heard it is perfectly identical with that which I have given, without suspecting the analogy, of the noise which the voltaic arc produces in the action of the magnetism.

The magnetic disturbances which always accompany the appearance of an aurora borealis are now easily explained. This accidental union of a greater proportion of the accumulated electricities must derange the normal action of the regular current; with respect to the directions of the disturbance, it will depend on the portion of the current acting upon the needle, and consequently on circumstances impossible to foresee, since they depend on the extent of the phenomenon and the position of the needle in relation to it. In fact, according as the horizontal plane in which the declination-needle moves comprises above or below some of the region in which the greatest activity of phenomenon takes place, it will be either the current circulating on the earth or that travelling in the air (currents which proceed in a contrary direction) which will act upon the needle ; even during the same aurora, it may be sometimes one, sometimes the other, of these two currents which will act. The variable directions in which the needle is deflected during an aurora borealis agree very well with this explanation, at least as far as I have been able to judge from the different observations published in the "Annales de Chimie et de Physique" and in several scientific voyages. The remarkable effect observed by M. Matteucci in the apparatus of the electric telegraph between Ravenna and Pisa, during the magnificent aurora of the 17th of last November, fully proves the existence of a current circulating on the surface of the earth, and which, ascending the wire of the telegraph, passed in part through this better conductor. The sounds which long iron wires strung in the direction of north to south give out under certain meteorological circumstances are undoubtedly a proof that they are traversed by a current which is probably derived from the currents circulating on the surface of the earth from north to south in our hemisphere.

It would be highly interesting and important to profit by those telegraphic wires, which are found to have a direction more or less approaching to that of the declination-needle, in order to make with them, when they are not in use for ordinary purposes, some observations which would enable us to demonstrate and to measure the electric currents which probably traverse them ; it would be easily accomplished by means of a multiplying galvanometer, by completing the communication of these wires with the earth at one of their extremities. The comparison of the results obtained in this manner with those furnished by the simultaneous observation of the diurnal variations of the needle would certainly present considerable interest, and might lead to meteorological results of a remarkable nature.

I cannot conclude this abstract without drawing attention to the circumstance that M. Arago had already pointed out in 1820, shortly after Œrsted's discovery, the possibility of acting upon the voltaic arc by this magnet, and the analogy which might result between this phenomenon and that of the aurora borealis.

THE CHEMICAL TIMES.

SATURDAY, APRIL 21, 1849.

MR. DROUET'S TRIAL FOR MANSLAUGHTER.

Mr. Drouet has been *acquitted* of the charge of manslaughter brought against him. This result might have been foreseen by any one acquainted with the peculiarities of the British law. The tenderness with which that law seems to look upon offences like the one with which Mr. Drouet was charged is truly marvellous. Nothing but the most *direct* evidence will satisfy its administrators that any *legal* wrong has been committed, however so enormous be the magnitude of the *moral* wrong, however so dreadful its consequences. In cases of theft we find the greatest possible difference in this respect. In such cases *everything* is considered evidence : the accused's general character, former convictions for offences against the law, suspicions that may have been cast upon the accused at any period of his life, no matter whether well-grounded or not, all and everything is lugged in to forge some additional link of the chain of evidence, and to secure, if possible, a conviction. In trials like that one through which Mr. Drouet has just now passed unscathed we see all evidence peremptorily rejected by the judge which, in the

opinion of that learned expositor of the law, is not *directly* and *immediately* connected with the case before the court. What matter to him the gross defects of the general arrangement of Mr. Drouet's establishment—what the positive and irrefutable proofs of general bad treatment of the children confided to that individual's care—"Prove to the satisfaction of the court," he exclaims, "that this treatment was actually pursued in the *individual* instance before us, and, moreover, which you have not done, that the deceased ever was in such a state of health as to render it probable that he would have recovered from the malady but for the treatment of the defendant." This latter omission the learned judge deemed fatal to the case against the prisoner, and it was upon this precise ground that he directed an acquittal, appending a somewhat *naïve* remark to the effect that "this omission might have been easily supplied by medical testimony"!—as if it were at all likely that an establishment conducted on *Mr. Drouet's* principles should have been permitted at any time to be much inconvenienced by visits from prying medical men, whose foolish notions of humanity might perchance *slightly* influence their opinion in the visitors' book; or who might even go so far as to complain to the "villanous *Times*," that awful organ which *will* take it into its head to find fault with *respectable* people for *trifling* transgressions of the divine and moral code,—transgressions such as the laws of society do not reach.

Let it be well understood we do not find fault with Mr. Baron Platt, the judge who tried the case: that learned functionary was simply the mouthpiece of the law, and was perfectly right in endeavouring to secure to Mr. Drouet all the protection granted to the accused by the law as it stands. It is with the law itself, or rather with its gross deficiencies and anomalies, that we find fault. Why should its meshes be left so wide in cases of offences against the person when we see them so tight-drawn in all cases where *property* is concerned?

Could any unprejudiced person—(for we except, of course, the individuals of the *Eaton* school, who forgot themselves so far in their joy at the lucky escape of their friend and *associate* in the management and treatment of paupers that they *positively cheered* the verdict of acquittal)—have heard the evidence adduced at the trial of Mr. Drouet, with its sickening and horrifying details, without arriving at a strong conviction of that person's *moral delinquency?*

And yet the *law* permitted him to walk away from its tribunal unscathed, if not actually with the air of *injured innocence!*

ETHEREAL OILS.

Ethereal oils and resins are connected as regards their origin; for the latter are produced from the former by the influence of the oxygen of the air. Ethereal oils are for the most part formed by the change of materials which takes place in the leaves. In mint and similar plants the oil is in the leaves, and is there preserved, because the plant is full of watery liquid. This production of oil is accompanied by the disengagement of oxygen from a substance in the leaves with which we are unacquainted. In fennel and anise plants this formation of ethereal oil also takes place in the seed, which must, therefore, give off oxygen during the ripening. In roses and other plants the same function is performed in the flowers; and hence it is, doubtless, that odoriferous flowers emit oxygen. True it is that ethereal oil is also found in calamas and some other roots, but the examples of such a function in the roots are far less numerous than of its occurrence in leaves and fruits; in a word, in those parts which give off oxygen. The ethereal oils diffused through the sap descend from the leaves through the bark, and supply to these the oils that are found there either unchanged,—for instance, oil of cinnamon, turpentine, &c.; or in an oxidized state, as resins, gum resins, and balsams,—for instance, benzoin, Peru balsam, storax, &c.

The best-known ethereal oils are the following:—

1. Oil of elemi, $C_{10} H_8$ (Deville).
2. Oil of lemons, $C_{10} H_8$ (Blanchet and Sell).
3. Oil of oranges, $C_{10} H_8$ (Voelckel).
4. Oil of copaiba balsam, $C_{10} H_8$ (Soubeiran and Capitaine).
5. Oil of calamus, $C_{10} H_8$ (Schnedermann).
6. Oil of fennel, $C_{15} H_{12}$ (Cahours).
7. Oil of juniper, $C_{15} H_{12}$ (Soubeiran and Capitaine).
8. Oil of cubebs, $C_{15} H_{12}$ (Soubeiran and Capitaine).
9. Oil of cloves, $C_{20} H_{16}$.
10. Oil of turpentine, $C_{20} H_{16}$ (Dumas).
11. Oil of sabine, $C_{20} H_{16}$ (Dumas and Laurent).
12. Oil of black pepper, $C_{20} H_{16}$ (Soubeiran and Capitaine).
13. Oil of pennyroyal, $C_{10} H_8 O$ (Kane).
14. Stearopt of the oil of basilieum, $C_{20} H_{16} + 6HO$ (Dumas and Peligot).
15. Oil of rosemary, $C_{45} H_{38} O_2 = 9 (C_5 H_4) + 2HO$ (Kane).
16. Oil of bergamot, $3(C_{10} H^8) + 2HO$ (Ohme).
17. Caryophyllin, $C_{20} H_{16} O_2$ (Dumas).
18. Oil of valerian $\left\{\begin{matrix}\text{Borneen, } C_{10} H_9 O^* \\ \text{Valerol, } C_{12} H_{11} O_2\end{matrix}\right\}$ (Gerhardt).
19. Oil of cajeput, $C_{10} H_9 O$ (Blanchet and Sell).
20. Oil of olibanum, $C_{35} H_{34} O$ (Stenhouse).
21. Oil of cumin $\left\{\begin{matrix}\text{Cyminum, } C_{20} H_{14}† \\ \text{Cuminol, } C_{20} H_{12} O_2\end{matrix}\right\}$ (Gerhardt and Cahours).
22. Tolen (the volatile oil of Tolu balsam), $C_{24} H_{18}$ (Deville).
23. Stearopt of rose oil, C H (Blanchet and Sell).
24. Stearopt of oil of peppermint, $C_{20} H_{20} O_2$ (Walter).
25. Oil of rue, $C_{28} H_{28} O_3$ (Will).
26. Stearopt of oil of marjorum, $C_{14} H_{15} O_5$ (Mulder).
27. Stearopt of oil of nutmeg, $C_{16} H_{16} O_5$ (Mulder).
28. Oil of cinnamon, $C_{20} H_{11} O_2$ (Mulder).
29. Concrete oil of anise (also in star anise and fennel), $C_{20} H_{12} O_2$ (Dumas, Cahours, Blanchet, and Sell).
30. Oil of spiræa (salicylous acid), $C_{14} H_5 O_3 + HO$ (Piria).
31. Cinnamein (in Peru and Tolu balsam), $C_{14} H_7 O_2$ (Fremy).
32. Helenin, $C_{15} H_{10} O_2$ (Gerhardt).
33. Oil of cina-seed (two oils unequally volatile), $C_{18} H_{15} O_2$ (Voelckel).
34. Cubebin, $C_{17} H_9 O_5$ (Soubeiran and Capitaine).
35. Oil of sage, distilled at 266° F., $C_{12} H_5 O$ (Roehleder).
    Oil of sage, distilled at 266° to 284°, $C_{18} H_{15} O_2$
    " at 302° F., $C_{12} H_{10} O$
    $= 2 (C_6 H_{2½}) O$
    $3 (C_6 H_5) O_2$
    $2 (C_6 H_5) O$
36. Anemonin, $C_{15} H_6 O_6$ (Fehling).
37. Oil of origanum, $C_{30} H_{40} O$ (Kane).
38. Coumarin (stearopt from Tonka beans), $C_{18} H_7 O_4$* (De Lalande).
39. Oil of artemisia, $C_{32} H_{21} O_3$ (Laurent).
40. Oil of cedar (solid), $C_{32} H_{26} O_2$ (Walter).
    do. (liquid), $C_{32} O_{24}$.
41. Stearopt of bergamot oil, C_3 HO (Mulder and Ohme).

Although we know little as yet of the history of the ethereal oils, we are warranted to consider the following facts as established:—

We find in them the following hydrocarbons:—

C_2 H as in No. 31.
C_3 H .... No. 41.
$C_5 H_4$ .... No. 1 to 19.
C H .... No. 23.

Only part of these contain no oxygen, as Nos. 1 to 12. Others are oxides or hydrates of this combination, as Nos. 13, 14, and 15, or hydrated oxides, as No. 30.

Those that deviate from this simple composition may be mixtures of two or more others, for it is very difficult to obtain them in a pure state.

It cannot be doubted that the hydrocarbons here enumerated ought to be called radicals, for as such they form combinations with other substances, such as hydrochloric acid. Their elements, however, cohere so slightly that part of the hydrogen may be easily exchanged for oxygen, the rest remaining behind. An instance of this may be given in the production of the resins of turpentine, $C_{40} H_{30} O_4$, which have been formed from $8 \times C_5 H_4 = C_{40} H_{32}$.

For this reason, the ethereal oils in plants are frequently altered by the influence of the air, and it is difficult to obtain them in the same state in which they originally existed in the plant.

There can be no doubt that the substances from which the ethereal oils in plants are produced belong to the general constituents of plants, for we find them everywhere. Now, seeing it may be considered as proved that fats are produced from starch, and since ethereal oils are in so far similar to fats that they contain little oxygen—and must, therefore, have been formed under similar circumstances—we may safely conceive that they originate from one of the soluble combinations of $C_{12} H_9 O_9$, + H O (starch, dextrin, &c.), through its exposure to the general deoxidizing influence which prevails in plants. At present we cannot go farther.

This conception, however, excludes the idea that there should be a variety of secreting organs corresponding to the variety of ethereal oils. On the contrary, we ascribe all their differences to small modifications of the circumstances by which the same cellular contents may be influenced—in the same manner as a slowly burning substance may yield quite different products, merely in consequence of small differences of temperature. The nature of the combinations of carbon and hydrogen, with or without oxygen, is as much determined by the impression which is imparted to the elements by the continual loss of oxygen expelled from the plant, as the temperature to which wood is exposed determines whether it shall yield acetic acid and different gaseous and liquid hydrocarbons, or simply carbonic oxide, carbonic acid, water, ammonia, and carbon.

We need scarcely point out that the formation of ethereal oils in plants is an abundant source of the oxygen disengaged. If they are directly or indirectly produced from $C_{12} H_9 O_9$ + H O, then there is certainly an opportunity for the production of various new substances, but a large quantity of oxygen will at the same time be set free; for, with the exception of the small portion of acids which are but sparingly found

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* Valerianic acid is $C_{10} H_9 O_3$. It seems, therefore, to be formed in the plant from borneen + O_2.

† According to De Lalande, the same oil, having the same properties, is obtained when camphor is distilled with anhydrous phosphoric acid.

* This differs from cinnamic acid ($C_{18} H_7 O_3$) only by one equivalent of oxygen. When coumarin is treated with potash an equivalent of hydrogen is driven off, and coumaric acid, $C_{18} H_7 O_5$, produced.

in plants, and exist in considerable quantity only in fruits, there are no substances, or, at least, none of general occurrence, that contain so much oxygen as the group—

$C_{12} H_9 O_9 + HO$ (Starch, dextrin, sugar, &c.)

When from this a compound $C_5 H_4$ is produced, there remains $C_7 H_5 O_9$; that is, a group containing nearly as much oxygen as tartaric acid, $C_8 H_4 O_{10}$,—an acid in which more oxygen is present than in any other organic acid, with the single exception of oxalic acid. For whatever purpose, therefore, the group $C_7 H_5 O_9$ may be employed, whatever substance may be formed from it, oxygen must be liberated, because all that can be produced from it contains less oxygen.

If, however, we consult observation, we find that the formation of ethereal oils is not attended with these secondary productions. In pine-wood, for instance, we find no secondary product at all, much less one of which the quantity can be compared with that of the produced oil of turpentine,—for the resin is a product of oxidation from the oil itself. We are, therefore, warranted in concluding that whatever substance, by its deoxidation, may give rise to the production of ethereal oils, it in most cases yields no other product,—and that, if the oil is one of the class $C_5 H_4$, the decomposition of $5 \times C_{12} H_9 O_9 = C_{60} H_{45} O_{45} + 3HO = C_{60} H_{48} O_{48}$, must produce $12 \times C_5 H_4 = C_{60} H_{48}$, and consequently 48 equivalents of oxygen must be disengaged.

A great number of ethereal oils are mixtures of two different ones, one of which has generally a greater tendency to combine with oxygen, and sometimes to form a stearopt, than the other. In such a case, the oil seems to have originated not from one but from a mixture of two substances.

The ethereal oils that contain nitrogen are compound groups, produced by the deoxidation of at least two substances; but from what substance their nitrogen has been derived we have no ground for stating. They do not appear to occur as such in the plant.

Lastly, caoutchouc, which, according to Faraday's analysis, has the composition $C_{10} H_9$, may in some degree be considered as related to ethereal oils in its origin, because it represents an analogous group. It is known that this caoutchouc is of general occurrence in plants containing milk-sap.—*From Mulder's Chemistry of Vegetable and Animal Physiology.*

ACETIC ACID.

Rapid acetification, or the quick formation of vinegar, was practised upon malt worts in this country long before the rapid conversion of alcohol into vinegar was introduced into Germany. In the year 1824 Mr. Ham obtained his patent for an improved method of making vinegar, like that described in Ure's Dictionary. His son, Mr. F. Ham, of Norwich, civil engineer, states that for some years four of the largest country manufactories in the kingdom have been at work upon his father's plan, and that they are now in successful competition with the great London establishments. The apparatus consists of a huge vat, in the centre of which is a revolving pump, having two or more shoots pierced with holes, whereby a constant shower of the fermented wort, called wash, is kept falling from the top. The underpart of the vat contains the wash; the upper part, birch twigs properly prepared, which are so placed as not to interfere with the revolving shoots. Between the surface of the wash and the rafters which support the twigs a space of a few inches is left vacant, into which one or more holes in the side of the vat admit the air spontaneously or have it forced in. The wash is maintained, by steam-pipes immersed in it, at a temperature of from 90° to 100° F., so that, in consequence of the extensive application of the atmospheric oxygen during the trickling through the twigs, it may be made sour in the course of forty-eight hours; but, in general practice, it is completely acetified in from fifteen to twenty days. By this apparatus a wort brewed from raw grain, with only one seventh of malt, will produce a vinegar equal to that from malt alone; and the acetifying process may be arrested whenever it is completed, thus preventing the risk of the vinegar running into the putrefactive stage, as happens occasionally in the slow plan of fermentation. The admission of air is so moderated as not to dissipate the alcohol of the wash by evaporation. A wort of 24lbs. gravity per Richardson's instrument, equal to 1.066 sp. gr., will in this way yield an acid of revenue proof.

This old-going process is essentially the same with that for which John W. Neale and James Edouard Duyck obtained a patent in September, 1841, with this difference, that they employ the expressed juice of beetroots instead of corn wort.

The total number of vinegar factories in the United Kingdom was a few years ago only 48, of which 5 of the principal are in London, 4 being on the Surrey side of the Thames. In these, malt-vinegar-making is associated with the manufacture of British wines, called "sweets" by the excise. The fermented wort or wash is acetified either by "stoving or fielding." By the first plan, casks containing the wash are arranged in close rooms, heated by steam-pipes or stoves. By the second plan, the casks, each holding somewhat more than 100 gallons, are laid on their sides, with the bungholes up, and distributed in long parallel rows, two or more deep, with narrow lanes between. A flexible pipe or hose, in connection with the wash-tun in the brewhouse, is laid alongside of the casks, for the purpose of filling them, and keeping them supplied in case of leakage or evaporation. The wash requires usually several months for its complete acetification, during which time the bungholes are left open in fine weather, but covered with a tile in the time of rain. When the acetous fermentation is completed, the contents of the casks are transferred by a syphon into a shoot laid on the ground, whence it is drawn by a pump into a store-vat within doors. It is next clarified in very large vats, called "rapes," because in them it is filtered slowly and repeatedly through a compacted heap of the stalks and skins of raisins, called rape, which is the refuse of the British wine manufacture.

In 1838, 2,628,978 gallons of vinegar paid duty in England; in 1839, 2,939,665; and in 1840, 3,021,130; upon which the gross amount of duty was, respectively, £21,908 3s.; £24,488 17s. 6d.; and £25,978 12s. 9d.

In Scotland, in the same years, 15,626 gallons; 14,532; and 12,967; on which the duty charged was, respectively, £130 4s. 4d.; £121 2s.; and £111 19s. 7d.

In Ireland, in the same years, 48,158 gallons; 50,508; and 56,812; on which the duty charged was, £401 6s. 4d.; £420 18s.; and £489 13s.

In the German process of Schützenbach for the rapid formation of vinegar, 180 measures (of 2 litres, or 2 quarts, each) of water are added to 20 of alcohol of from 44 to 45 per cent. by Tralles, and $6\frac{1}{2}$ of vinegar, containing $3\frac{1}{4}$ per cent. of acetic acid. These $206\frac{1}{2}$ measures produce on the average 203 to 204 of vinegar of the above strength. The process of acetification in the graduation-tubs (*gradirfässer*) is finished in about forty-eight hours, and furnishes a vinegar of only 2.75 per cent. of acid strength. The liquid still contains some unchanged alcohol, and it is, therefore, transferred into tuns, where it completes its oxygenation. The heat of the chamber being about 90° F. occasions the stream of air that is passed through the above materials to carry off unproductively one tenth of the alcohol at least. Of the air that passes through the apparatus, only 3 per cent. of its oxygen is converted into carbonic acid.* An increase in the proportion of alcohol in the mixture is not found favourable to increased production of vinegar.

The theory of the acetification of alcohol was first fully cleared up by the researches of Liebig on aldehyde. For the production of 100 pounds of hydrated acetic acid, 53 pounds of oxygen are required, which are contained in 227 pounds of air, and oxygenate 77 pounds of absolute alcohol.

The conversion of the alcohol of fermented liquors into vinegar may be chemically represented as follows:—Alcohol is a compound of 4 atoms of carbon, 6 of hydrogen, and 2 of oxygen, or in symbols $C_4 H_6 O_2$. In certain circumstances (as the first stage of acetification) it loses 2 atoms of hydrogen, and becomes aldehyde, or dehydrogenated alcohol, $C_4 H_4 O_2$. This body readily absorbs 2 atoms of oxygen on exposure to the air, and thus forms 1 atom acetic acid; in symbols, $C_4 H_3 O_3 + 1$ atom water (H O). These results are obtained in the exposure of vapour of alcohol to platinum sponge, or platinum mohr. In all cases it is presumed that aldehyde is first produced, then vinegar. The quick vinegar process has been in this country advantageously applied to the acetification of a solution of starch sugar made by the agency of either malt or sulphuric acid. But, as our excise-laws are adverse to the spirituous fermentation of such sugar, the starch liquor, after being boiled with 1 per cent. of sulphuric acid, is directly fermented into a crude wash, which is then acetified by the following method:—

A very large slightly conical tub or tun, 14 feet wide at bottom, 15 at top, and 13 high, turns out in a given time as much vinegar as is in Germany obtained from 6 tubs 8 feet high and 4 feet wide. Our larger mass of materials generates and maintains so much heat in the oxidation of the spirit as to require no stove-heating in a properly constructed chamber. Two and a half feet above the bottom of the above tun a false bottom is laid. The space above this bottom is filled with coopers' wood shavings and chips, and the space beneath is destined to receive the liquor as it trickles down on the true bottom, in order to be pumped up in continual circulation. At a moderate height above the tun the reservoir of the wash is placed, which discharges itself through a regulating stopcock or valve into a pipe in its bottom, which passes down through a pretty large hole in the middle of the lid of the tun, and terminates a few inches under it, in a cross pipe shut at the ends, which is made to revolve slowly by mechanical power, in a horizontal direction round the end of the vertical pipe. This cross pipe is long enough to reach nearly to the sides of the tun, and, being pierced with small holes in its under side, delivers the fermented liquor, in minute streams, equally all over the surface of the chips of wood. It thence falls into the lower compartment of the tun, through holes round the circumference of the false bottom, whence it is pumped up again, under certain modifications, to be presently described.

The air for oxygenating the alcohol into vinegar is supplied from two floating gasometers, which are made to rise and fall, alternately, by steam power. The ascending one draws its air from a pipe which passes into the centre of the tun, immediately under the false bottom, and, as it redescends, it discharges that air through a pipe into a cistern of water, which condenses, and retains the whole alcoholic vapour drawn off with the air. This water is used in making the next acetifying mixture. The fresh air is admitted in the top of the tun by the sides of the vertical liquor-pipe, which is somewhat smaller than the hole through which it passes. Proper valves are placed upon the pipes connected with the gasometer-pump, whereby the air drawn from the bottom compartment is prevented from returning thither. A small forcing-pump is employed to raise the liquor continually from the bottom of the tun to the cistern overhead. By this arrangement good vinegar may be made in a few days, without any perceptible loss of materials. The progress of the acetification in this apparatus is ascertained by testing the air for oxygen as it is slowly drawn into the gasometers, or expelled from them. For this purpose a bundle of twine,

* *Knapp*, "Annal. der Chem. und Pharm.," xlii., 113.

which has been impregnated with solution of sugar of lead, and dried, is set fire to, and plunged into a bottle filled with the air. In general, it is so well disoxygenated and carbonated that the ignition is immediately extinguished. By regulating the warmth of the apartment, the motion of the gasometer, and the admission of air, the due progress of the acetification may be secured. The vinegar has an average strength of 5½ per cent. of acetic acid hydrate, and is immediately ready for the market.

Hitherto it has been generally imagined that the formation of vinegar is accomplished by a peculiar fermentation, which has been called the acetonus, in contradistinction from the vinous, the panary, the putrefactive, &c. But this doctrine is doubtful. The experiments which serve as its base, and which should reveal the nature of its peculiar ferment, as also the chemical reactions which take place in its progress, all seem to place this phenomenon somewhat out of the sphere of fermentation properly so called. Every fermentation operates by resolving a body into compounds less complex than itself. But the so-called acetic fermentation serves to combine, on the contrary, two bodies, namely, alcohol and aldehyde, with the oxygen of the air; and this is the only case where fermentation produces such an action, which is a true combustion.

Yet it must be confessed that the acetic acid seems to possess all the characters of the other fermentations; namely, the union of an organized body or ferment with a fermentable organic matter. The former is found in that mucous substance called mother of vinegar, and which is seen floating on the surface of vinegar in the act of its generation. It begins to appear with the acid fermentation, and it continues to be formed during its whole progress. It is at first a pellicle, composed of globules much more minute than those which constitute yeast; and they are often irregularly grouped. The pellicle becomes afterwards thicker in body and consistence, exhibits more distinct granular forms, and acquires a tendency to be distributed in stripes or narrow bands. The mode of the reproduction of these globules is quite unknown; but they seem somewhat akin to the slimy deposit of sulphureous mineral waters called baregine.

If the study of the acetic ferment be mysterious, it is, however, clear that the conversion of alcohol into vinegar never takes place in the common process without the presence of an albuminous substance, and of the conditions favourable to all fermentations besides the necessary access of air, not only at the commencement (as suffices for the vinous) but during all its course. Hence every weak spirituous liquor which contains an albuminous matter or any ferment may, with contact of air, and a temperature of from 60° to 90° F., give birth to vinegar. If the mixture be too rich in alcohol, or if the azotized matter be absent, or if the temperature be much above or below these two points, the phenomenon of acctification stops. There are, therefore, several indications of the existence of a peculiar vinegar fermentation; though it should be observed that the production of lactic acid (as from fermenting cabbage, starch, &c.) has sometimes misled chemists into the belief of an acetic fermentation. I shall, on this account, point out here briefly the distinction between the two processes.

The acetic fermentation requires the presence of ready-formed alcohol and of the air; the lactic, on the contrary, proceeds with starchy or saccharine mixtures, without the intervention of alcohol or of atmospheric oxygen; and when once begun it will go on of itself. The acetifying process presents, moreover, a striking analogy with the nitrification in the necessity of an elevated temperature and the influence of porous bodies to divide the particles of the liquids and the air. Thus gaseous ammonia, mixed with oxygen, when passed through a tube containing spongy platinum, slightly heated, becomes nitric acid; when sulphurous acid gas and oxygen are passed through hot pumicestone they become sulphuric acid; and when lime or potash, diffused through porous matter, is placed in contact with ammoniacal emanations, in the artificial nitre beds, or nitrifiable soils, nitrate of lime or potash is formed. In like manuer, under the influence of spongy platinum, alcohol ($C_4 H_4 O + H_2 O$) and air may, by a true oxidizement of the ethereous part of the alcohol ($C_4 H_4 O$), produce aldehyde ($C_4 H_4 O_2$), which passes afterwards into acetic acid ($C_4 H_3 O_3$ + water, HO). On these principles we may conceive that vinegar must be readily formed when alcoholic wash, at a proper temperature, is extensively exposed to atmospheric air, by being spread over the surfaces of wooden twigs, or chips, in the German graduators. In some districts cider is rapidly acetified by being made to trickle cautiously along strings suspended vertically between two vats.—*Ure's Supplement to his Dictionary of Arts, Manufactures, and Mines.*

NATURE OF THE BLOOD DRAWN AND DISGORGED BY LEECHES.

M. Reveil has shown that the blood obtained from the capillaries is exactly similar in composition to the sanguineous fluid in the veins. In order to analyze the blood drawn by leeches, M. Reveil caused some of these annelidæ, which had fallen off after sunction, to disgorge by compression, and he found that all the blood thus obtained was devoid of fibrine. The latter, in fact, remains in the leech; and it seems that a complete decomposition or separation of the constituent parts of the blood takes place within the animal. Thus may be explained the fact, that leeches cannot efficiently be used again until after about two months from their first application; we should wait until they have digested the fibrine, of which compression cannot deprive them.—*Répertoire de Pharmacie*, Janvier, 1849.

M. Berry, Middlesex, engineer, for certain improvements in the construction of rotary steam-engines. Patent dated April 8th, 1835; expired April 8th, 1849.—(Communication.)

TO CORRESPONDENTS.

"A Subscriber from the Commencement."—We beg our correspondent's pardon. It should have been No. 65 instead of No. 62.

"V. P. T."—The "esprit de violettes," or essence of orris, is prepared from the orris root, and not from the flowers. You may follow either of the two following processes:—

I.

Take of Florentine orris-root, reduced to coarse powder, ¼ pound.
Rectified spirit of wine, 1 pint.
Digest for fourteen days; strain with expression.

II.

Take of Coarsely-powdered Florentine orris-root, 5 pounds.
Rectified spirit of wine, 1 gallon.
Digest for fourteen days; strain, and submit the root to powerful pressure in a tincture-press, to extract the last portions of the liquor. Filter. The product is very fragrant.

The extract of elder or "elder rob" is made of the elder berries, and not of the flowers. It is the expressed and depurated juice of elder berries, evaporated to the consistence of honey. If you wish to prepare an extract of the flowers, reduce the dry flowers to a coarse powder, moisten this with its own weight of water, pile it gently in a lixiviation apparatus, and lixiviate. Evaporate the product to the consistence of extract.

"A Country Chemist."—The label forwarded to us by our correspondent is liable to the duty.

"E. L."—Procure Adrien de Jussieu's "Elements of Botany," translated by J. H. Wilson, published by John Van Voorst. There is no "*Lindleian*" system, properly so called. The *Linnean* system has been superseded by that of Jussieu, which we recommend you to study.

"Mr. Frederick W. Griffin, Bristol."—We intend to act in future upon the suggestion made by our correspondent. In the two cases more particularly alluded to in his letter it would be rather too late now to insert a notice in our pages.

"Mr. Millar, Birmingham."—We have not obtained any positive information on the subject; yet we think we know sufficient of it now to feel justified in dissuading our correspondent from embarking in the enterprise.

"W. R. C."—Write to the *Law Times*. We cannot give advice on legal points.

"G. W. M."—We think the article will answer exceedingly well. The sooner you take out a patent for it the better.

"Mr. J. Taylor."—The *Chemical Times* has no connection whatsoever with the gentleman named in your letter.

"J. T."—The letter which our correspondent has forwarded to us, with a request to insert it in our paper, is a libel; we should render ourselves liable to an action for defamation of character were we to comply with our correspondent's request. We have no objection to insert a plain statement of facts, if properly authenticated.

"An Oil and Colour Man."—You will see that we have complied with your request.

"A Young Publican."—Yellow usquebaugh, or escubac, is prepared as follows:—Take of proof spirit, 3 gallons; hay saffron and juniper berries, of each 1 ounce; stoned dates and raisins, of each, bruised, ¼ pound; mace, cloves, coriander, and aniseed, of each ¾ ounce; cinnamon, ½ ounce. Digest till sufficiently flavoured and coloured; filter, and add to the filtrate capillaire or simple syrup, 1 gallon.

"A. B. C."—Extract of scammony is prepared as follows:—Boil finely-powdered scammony in successive portions of proof spirit till all the soluble matter is dissolved. Filter, and distil the liquid until the fluid which passes over consists almost exclusively of water. Pour off the remaining water from the resin at the bottom of the alembic, and wash the residuary resin with successive portions of boiling water; dry the product finally at a temperature below 240° Fahrenheit.

"Inventor."—The machine seems to us a colourable imitation of your own. We would advise you, however, to consult Mr. Carpmaël upon the subject before you take legal proceedings.

"An Apprentice."—Procure Rose's "Manual of Analytical Chemistry." Apply to Professor Hofmann, at the Royal College of Chemistry, Hanover-square.

"Inquirer."—Catgut is not made of the intestines of the *cat*, but of those of the *sheep*.

"J. T."—Haller's acid elixir is a mixture of equal parts of sulphuric acid and alcohol.

"Mr. Wood."—If you will furnish us with the details we will give you our opinion on the chances of the patent.

"Mineralogist."—Pumicestone is a spongy, vitreous-looking mineral, consisting of fibres of a silky lustre, interlaced with each other in all directions. It floats upon water, and is harsh to the touch. Its mean specific gravity in the mass is 0 914. Though brittle, it is hard enough to scratch glass and most metals. Its colour is usually greyish-white, but sometimes bluish, greenish, reddish, or brownish. Before the blowpipe it fuses into a white enamel. According to Klaproth, it contains in 100 parts:—

Silica	77.5
Alumina	17.5
Oxide of iron	2
Potass and soda	3
	100.0

The acids have hardly any action upon pumicestone. It is used for polishing ivory, wood, marble, metals, glass, &c.; and also skins and parchments. The French call it Pierre-ponce, the Germans Bimstein. Pumicestone is usually considered to be a volcanic product, resulting, probably, from the action of fire upon obsidians. The chief localities of this mineral are the islands of Lipari, Ponza, Ischia, and Vulcano. It is also found in the neighbourhood of Andernach, on the banks of the Rhine; in Teneriffe, Iceland, Auvergne, &c. It is sometimes so porous that its specific gravity is as little as 0.37.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LIII.

(LECTURE LXXXI.)

TANNIN.

SECTION II.—SUBSTANCES WHICH CONTAIN TANNIN AND ESSENTIAL OIL.

The medicinal substances in which the tannin is associated with essential oil are generally used as stimulants. The stimulating properties of the essential oil are combined in them with the tonic properties of the tannin.

CINNAMON.

Cinnamon is the second or inner rind or bark of Laurus cinnamomum. It contains an abundant proportion of volatile oil. In medicine it is used as a tonic, stimulant, and cordial.

It contains:—

Volatile oil,
Tannin,
Mucilage,
Colouring matter,
Cinnamic acid,
Starch.

The volatile oil of cinnamon has a light yellow colour; in the course of time it turns brownish; its density is a little higher than that of water. It solidifies at 32° F., and liquefies at 41° F. It has a peculiar aromatic odour. It distils at a high temperature, but a portion of it suffers alteration during the process. It is very readily soluble in alcohol.

According to Dumas and Péligot, the composition of the essential oil of cinnamon is represented by the formula:—

$$C_{18}\,H_8\,O_2.$$

We may, upon a similar theory to that adopted by Wöhler and Liebig for bitter almond oil, regard the essential oil of cinnamon as a compound of one equivalent of hydrogen with one equivalent of a compound radical (cinnamyle), composed of:—

$$C_{18}\,H_7\,O_2.$$

Upon this assumption the essential oil of cinnamon would accordingly be the hydruret of cinnamyle.

The oil of cinnamon, when exposed to the air, absorbs oxygen; the hydrogen which constitutes the hydruret combines with part of the absorbed oxygen to water, whilst, on the other hand, one equivalent of oxygen combines with the radical, with which it forms cinnamic acid.

Cinnamic acid is accordingly a compound of one equivalent of cinnamyle and one equivalent of oxygen. The free cinnamic acid contains an equivalent of water. It greatly resembles benzoic acid, from which it differs, however, in several important particulars, viz.:—Nitric acid forms with it at a temperature below 140° Fahrenheit an almost insoluble crystalline compound, to which Mitscherlich has given the name *nitrocinnamic acid;* at a higher temperature it yields, first, bitter almond oil; subsequently, benzoïc acid. Chloride of lime converts it into benzoate of lime.

Hydrochloric acid and ammonia form with the oil of cinnamon crystallizable compounds. When the oil of cinnamon is acted upon by chlorine it loses hydrogen, and forms with the chlorine a chloride of cinnamyle. Solution of potass exercises no action upon oil of cinnamon. When this oil is treated at a high temperature with hydrate of potass hydrogen is evolved, and a new substance formed, which appears to be cinnamate of potass.

There exists, indeed, considerable analogy between the oil of cinnamon and that of bitter almonds; but the radical cinnamyle is less stable than benzyle, and is frequently, by a different molecular arrangement, converted into the benzoic radical.

The preceding remarks apply exclusively to the oil of Ceylon cinnamon, or, to speak with greater exactness, to the oil produced from the nitric compound.

The essence obtained from cinnamon by distillation contains, according to MM. Blanche and Sell, two distinct volatile oils; the one heavier, the other lighter, than water. It is certain, besides, that the oil of Ceylon cinnamon alone is solidified by the action of nitric acid, which tends to show that the other oil consists of a mixture of hydruret of cinnamyle with some other essences. Mulder tells us, moreover, that the oil of cinnamon presents the composition given by Dumas and Péligot only after having been in contact with the air. According to this chemist, the oil of cinnamon recently obtained by distillation in non-aërated water, and the contact of air otherwise being precluded, contains:—

$$C_{20}\,H_{11}\,O_2.$$

Upon subsequent exposure to the air this oil suffers alteration, being resolved into cinnamic acid, water, two resinous matters, and the volatile oil analyzed by Dumas and Péligot.

The tannin of cinnamon exists in that bark, according to Vauquelin, in combination (at all events a part of it) with an animal matter. This tannin compound is insoluble; yet we find it dissolved in the infusions of cinnamon: its solution is effected here probably by the presence and influence of the acid principle.

CINNAMON POWDER.

Reduce the cinnamon to powder without leaving a residue.

The cinnamon powder is used as a tonic at the dose of a few decigrammes; in larger doses it acts as an energetic stimulant.

SIMPLE DIGESTIVE POWDER.

Take of Cinnamon in powder, 1 part.
Sugar, 16 parts.

Mix.

This powder is given as a stomachic, tonic, and stimulant, at the dose of 8 to 12 grammes.

ELÆOSACCHARUM OF CINNAMON.

Take of Essential oil of cinnamon, 1 drop.
Sugar, 4 drops.

Mix.

DISTILLED WATER OF CINNAMON.

Take of Ceylon cinnamon, 1 part.
Water, 8 parts.

Pound the cinnamon, put it into the cucurbite of an alembic with the water, let it macerate for two days, and distil, taking care to cool the worm only to a certain extent. Distil over four parts of product.

The product is milky, from the oil which it holds in suspension. This oil subsides very slowly, as its density differs very little from that of water. It subsides, however, in the course of time; the subsidence of the oil is attended with formation of crystals of cinnamic acid.

The distilled water of cinnamon yields, with iodurettted iodide of potassium, brownish-red crystals of metallic lustre, which, according to Apjohn, consist of a compound of iodide of potassium with hydruret of cinnamyle.

ALCOHOLIZED WATER OF CINNAMON.

Take of Cinnamon, 3 parts.
Alcohol of 86 Cent. (34° Cartier), 1 part.
Water, 24 parts.

Macerate for three days; distil to obtain 12 parts of product.

Operating upon about two pounds and a half of cinnamon, and fractioning the products, I have obtained:—

1. Two quarts of a very milky water, with a great deal of essential oil at the bottom;
2. Two quarts somewhat less milky, but containing likewise a large proportion of precipitated oil;
3. One quart still containing precipitated oil;
4. One quart slightly milky only, and with hardly any oil at the bottom;
5. Two quarts slightly milky only, and perfectly free from a deposit of essential oil.

I distilled subsequently pure water over the same quantity of cinnamon, and fractioned the products as before. I obtained:—

1. Two quarts of a very milky liquid from which oil separated.
2. Two quarts very slightly milky.
3. Two quarts free from any appearance of milkiness.

The results of these experiments prove that a much larger portion of oil passes over with the alcoholic than with the purely aqueous products, and accordingly that the presence of alcohol favours the separation of the essence, and that the alcoholic distillate must necessarily exercise a more energetic action than the aqueous distillate, not only from the presence of the alcohol, but also because it contains a larger proportion of essence.

ALCOHOLATE OF CINNAMON.

Take of Fine cinnamon, 1 part.
Alcohol of 80 C. (31° Cartier), 8 parts.

Let the cinnamon macerate in the alcohol for a few days, and distil subsequently to dryness at the heat of the water-bath.

CINNAMON SYRUP.

Take of Distilled water of cinnamon, 100 parts.
Very white sugar, 190 parts.

Make a syrup by simple solution at a very gentle heat, and filter through paper.

This is the formula of the Codex: the syrup looks very pure, and has a most agreeable flavour.

TONIC SYRUP OF CINNAMON.

Take of Cinnamon, 1 part.
Distilled water of cinnamon, 16 parts.
Sugar, a sufficiency.

Let the cinnamon digest in the distilled water in a close vessel, strain, and add to the strained fluid 190 parts of sugar for every 100 parts of liquid. Dissolve in a close water-bath. Strain the syrup when cold.

TINCTURE OF CINNAMON.

Take of Cinnamon, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Let the cinnamon macerate in the alcohol for fifteen days; strain with expression, and filter.

The alcohol dissolves all the active principles of the cinnamon.

CINNAMON WINE.

Take of Cinnamon, 1 part.
Alcohol of 80 C. (31° Cartier), 2 parts.
Red wine, 30 parts.

Pound the cinnamon, pour the alcohol over it, and let it stand for twenty-four hours. Add the wine, and, after a few days' maceration, strain and filter.

This wine, when sweetened with sugar, is usually called hypocras. Other aromatic principles, such as musc, ambergris, &c., are also frequently added to it.

VINOUS SYRUP OF CINNAMON.

Take of Cinnamon wine, 2 parts.
White sugar, 3 parts.

Make a syrup by solution in the cold, and filter.

CORDIAL POTION.

Take of Red wine, 125 grammes.
Sugar syrup, 32 grammes.
Cinnamon tincture, 8 grammes.

Mix.—(Formula of the Paris hospitals.)

CANNELLA ALBA.

The bark of Cannella alba contains, according to the analysis of MM. Petroz and Robinet:—

Mannite,
A bitter principle,
Resin,
A highly acrid volatile oil,
Albumen,
Gum,
Starch.

The volatile oil is composed of two distinct essences. The one, which constitutes the greater part of the crude essence, and is oxygenized, greatly resembles the oil of cajeput; the other

has the odour of cloves, and combines with alkalis; this is the earyophyllic or eugenic acid.

Cannella alba is now hardly ever used. The powder is given sometimes as a tonic and stimulant, at the dose of a few decigrammes. It is one of those energetic agents of which the use has been abandoned simply because the materia medica happens to be well stocked with substances of a similar nature. The same may be said of Winter's bark, and of many other substances of the kind.

M. Henry has analyzed Winter's bark (Winterana aromatica). He found in it :—

Essential oil,
Resin,
A little extractive matter,
Tannin,
Several salts.

CLOVES.

Cloves are the non-expanded flowers of Caryophyllus aromaticus. The clove is one of our favourite spices. It has been analyzed by Trommsdorf, who found in it :—

Volatile oil,
A peculiar species of tannin,
Gum,
Resin,
Extractive,
Caryophyllin.

According to Trommsdorf, the tannin of the clove is less acerb than common tannin, and the compound which it forms with gelatine has less elasticity.

The pure essential oil of cloves has an acrid taste, less acrid though than the commercial oil, which the Dutch prepare frequently of a mixture of cloves and Jamaica pimento.

The density of the essential oil of cloves is 1.061.

The oil is not very volatile; it solidifies only at a very low temperature (—0.4 to —4° F.).

Nitric acid colours it green, according to M. Bonastre; red, according to M. Brandes.

The oil of cloves contains three different substances, viz. :—

1. An oil formed of hydrogen and carbon, in the same proportions as these elements are combined in essence of turpentine. This oil was discovered by M. Ettling. It is lighter than water.

2. An oxygenized oil (the eugenic acid of Dumas), which constitutes the greater part of the essence. The formula of this oil is :—

$$C_{20}\,H_{12}\,O_5.$$

It combines directly with potass to a salt with excess of acid, and in which the oxygen of the acid is to that of the potass as 10 to 1. The eugenic acid boils at from 307.4 to 309.2 F.

3. Stearoptene (the eugenin of Persoz), which contains one equivalent of oxygen less than the eugenic acid. The same stearoptene forms also in the course of time in the distilled water of cloves. It crystallizes in thin, white, nacreous plates; in the course of time it acquires a slight yellowish tint; it has little taste, and emits less odour than the essence of cloves. It is soluble in all proportions in water, and in alcohol; like the essence, it acquires a lively red colour when acted on by nitric acid.

To separate the eugenic acid from the hydrocarburetted oil, the crude essence is to be mixed with concentrated solution of potass; the mixture concretes into a buttery and crystalline mass. The eugenate of potass dissolves, and the hydrocarburetted oil separates. The eugenic acid may then be obtained from the eugenate by means of an acid.

The volatile oil of cloves is produced by the distillation of cloves with water and salt, in the same way as all the heavy volatile oils. To obtain the whole amount of oil contained in the cloves requires repeated cohobations, since the oil is not over volatile, and is moreover strongly retained by the species of green resin with which it is naturally associated in the clove.

Caryophyllin has been studied by MM. Lodibert and Bonastre. It is a species of crystalline resin, of a brilliant satin-like aspect; it has neither taste nor smell; it is fusible and volatile; it is insoluble in water; it dissolves in boiling alcohol and in ether; it is also soluble, though to a trifling extent only, in caustic alkalis.

When acted upon by concentrated sulphuric acid it acquires a coquelicot-red tint. It is isomeric with camphor; its formula is :—

$$C_{20}\,H_{16}\,O_2.$$

The clove is one of our most energetic stimulants; it forms an ingredient of Sydenham's laudanum, and of several other preparations. The essential oil of cloves is used as a stimulant, and also as a remedy against the toothache from decayed teeth.

Cloves are mostly administered in the form of powder or tincture.

ALCOHOLATE OF CLOVES.

Take of Pounded cloves, 1 part.
Alcohol of 80 C. (31° Cartier), 8 parts.

Let the cloves macerate for a few days in the alcohol, and distil subsequently to dryness.

TINCTURE OF CLOVES.

Take of Cloves, 1 part.
Alcohol of 80 C. (31° Cartier), 5 parts.

Let the cloves macerate for fifteen days in the alcohol; strain with expression, and filter.

SAPONIN.

The root of Saponaria officinalis, the root of Gypsophylla struthium, the bark of Quillaia smegardermos and Quillaia molinæ, and the roots of Smilax salsaparilla and Polygala senega, contain all a white acrid matter, soluble in water, and possessed of the curious property of forming a lather when agitated with water.

Saponin has been carefully studied by MM. Bussy and Fremy. The following are the properties and distinctive characteristics of this principle :—

It is a white, pulverulent substance; its taste is acrid, though not immediately perceptible. Brought into contact with the olfactory membranes, it acts as a powerful sternutatory. It dissolves readily in water. The addition of 1 part of saponin to 99 parts of water suffices to obtain a strong lather. Saponin is soluble in all proportions in dilute alcohol; it is less readily soluble in strong alcohol, and insoluble in ether. Baryta-water, subacetate of lead, and gallnut precipitate saponin from its solutions. Nitric acid dissolves saponin in the cold; when nitric acid is made to act upon saponin at a high temperature, the saponin is decomposed, and mucic acid and a yellow resin are obtained.

Hydrochloric acid dissolves saponin; the hydrochloric solution subsequently deposits gradually esculic or saponic acid; this acid is insipid; it crystallizes in large crystals which are soluble in alcohol, but almost insoluble in water.

Alkalis dissolve saponin. Upon evaporating a solution of saponin in potass, esculate of potass is obtained; from this salt the esculic acid may be readily separated by means of an acid.

Saponin may be readily obtained from Indian chesnuts by treating the latter with alcohol of 36°, distilling off the alcohol, and treating with ether, which removes the fatty matter adherent to the saponin.

The saponin extracted from Indian chesnuts is identical with that extracted from the Gypsophylla struthium.

The saponin extracted from Salsaparilla (and which is called Salsaparin) differs from that obtained from Indian chesnuts, and from the Gypsophylla struthium, in this, that it crystallizes more readily than the latter, is only sparingly soluble in water, and is not converted into esculic acid by the action of hydrochloric acid.

The saponin principle extracted from Polygala senega by M. Quevenne, and to which that chemist has given the name of polygalic acid, is also only sparingly soluble in water. With hydrochloric acid it yields a bitter and gelatinous acid.

Saponin exercises evidently a marked action upon the animal economy. Its acrid taste and the property which it possesses of forming a lather with water leave no doubt but that the substances which contain it owe to its presence part of their medicinal properties.

We cannot affirm, on the other hand, whether the other principles with which it is associated in the substances contribute or not to the therapeutic action of the latter.

SOAP-WORT.

We employ in medicine the leaves and root of Saponaria officinalis.

Both the leaves and root of this plant contain saponin; this principle has not, however, as yet been extracted in a state of purity from the root of Saponaria.

Besides saponin, the root of Saponaria contains, according to Bucholz :—

A small quantity of soft resin,
Extractive,
Gummous matter,
Albumen.

The leaves contain, besides saponin, chlorophyle.

Osborne found that the root of Saponaria, gathered before the blowing time of the plant, yields upon evaporation a crystalline, bitter, neutral, fusible matter, soluble in water, alcohol, and ether, insoluble in essence of turpentine.

PTISAN OF SAPONARIA.

This is the form in which the roots and leaves of Saponaria are most frequently administered. The leaves are chopped up, the root is pounded; both are treated by infusion. The usual dose is 12 grammes of the leaves, 20 grammes of the dry root.

EXTRACT OF SAPONARIA.

This extract may be prepared either with the root or with the leaves; lixiviation is the process resorted to in either case; the dry leaves, or the dry roots, are reduced to a state of a coarse powder, which is then moistened in the first place with one half its weight of cold water. The leaves must be piled rather loosely in the lixiviation apparatus; the roots require to be piled still more loosely than the leaves.

100 parts of the leaves of Saponaria yielded by lixiviation with distilled water 38 parts of extract; one part of the extract represents accordingly 2.6 parts of the dry leaves.

100 parts of the root yielded by the same process 33 parts of an exceedingly aerid extract. One part of this extract represents accordingly 3 parts of the root.

100 parts of the root, treated with alcohol of 56°, yielded 25 parts of alcoholic extract.

SYRUP OF SAPONARIA.

Take of Alcoholic extract of saponaria-root, 1 part.
Hot water, 2 parts.
Sugar syrup, 16 parts.

Dissolve the extract in the hot water, filter the solution, and add the filtrate to the properly concentrated syrup.

Ten grammes of this syrup represent 60 centigrammes of the alcoholic extract, equivalent to about 2 grammes of the root.

ON THE APPLICATION OF PHYSICAL SCIENCE TO AGRICULTURE.

Read before the Royal Society, Dublin, on the occasion of the Cattle Show, on Wednesday, April 18, 1849.

By Dr. W. BARKER.*

If there be any source from whence we may derive present course of gratification and hope for the future, it is from the altered tastes and tendencies of the upper classes in this unhappy country. In the exhibition of this day, bringing forward the results of their skill and energy, and in the meeting of this evening, we must indeed find ample cause for gratulation and hope, based upon the most substantial grounds; since no good which springs up amongst the natural directors of our agricultural classes, no energy

* Communicated by the author.

which they display, no self-cultivation which they exhibit, no encouragement which they hold out to the advances of high civilization, but must, ere many years, in the natural and inevitable order of events, extend downwards, and become rooted in the soil of the country, extending their ramifications over the whole framework of society, and producing their fruits of peace, order, and prosperity. Few who remember or are traditionally acquainted with the state of this country during the last half century but must know that many, if not most, of the evils under which it has suffered are those entailed by the ignorance or immorality of a former epoch reacting upon the mass of the people. Our aristocracy and gentry now suffer from this reaction—to this class it may be truly said, *delicta majorum immersit lues;* but whilst they suffer the penalties of other men's misdeeds, and endure the odium of others' crimes of omission and commission, they may proudly feel that their perseverance in well-doing must have its reward in the advance of a future, if not of the present, generation in the arts of civilization, and that at least their children may enjoy the harvest of peace, and the fruits of industry, of which they are labouring to sow the seeds. That this change of the habits and tastes of our gentry has taken place almost naturally needs but little evidence to prove. Who hears now of the Hellfire Club, with its drunken profligacy, and attendant and inseparable vices? Such things have ceased to cast a dark shadow on our national character, and we find that intellect, morality, and industry, are gradually supplanting stupidity, indolence, and crime; the rivalry of vice has given place to the emulation of virtue, and the struggle is beginning of endeavouring to produce the highest amount of the fruits of industry, and the best examples of moral and physical culture. That this change will soon show its effects on the masses of the people we have already proofs—the convivial debauchery of a past age is no longer reflected in the drunken orgies of our peasantry; and may we not indulge the hope that the time is not far distant when another apostle will arise who may lead the people from obedience to habits of indolence, of carelessness, and of crime, as the apostle of temperance has from one vice more difficult to resist, and more nationally characteristic, as soon as your exertions and your example have prepared the way for his labours to prove effective?

If the view I have taken in these observations be correct, that all or most of the improvements of a country must commence amongst its higher classes—and in this view I think I am borne out by all historical evidence—how important is it that those who form these classes should endeavour to fit themselves for their high and, I may add, their holy destiny, and strive after the most efficient means of fulfilling what must be so dear an object of desire to all who seek to serve their country? Of the many ways in which this may be accomplished it would be presumption in me to attempt to point out; there is, however, one, which, though secondary to many others, is yet of such great importance that I will trespass on your time by referring to it by a few observations—I mean an acquaintance with those general laws of nature embraced under the heads of natural history and natural philosophy, especially in their important practical bearings on the different branches of agriculture. To the former I will make no further allusion than by referring to the interesting communication we have already had in which we have had proof how practically valuable, as well as interesting, even the most abstruse and difficult branch of botany may prove to the farmer; but to the latter I may be permitted to make more especial reference, and bring forward a few practical applications to prove how far even abstract considerations have advanced the power, and may be made serviceable for the every-day uses, of agricultural life; and, in doing this, I do not mean to claim for these sciences that deep consideration of abstract truths which may suit the leisure of the mathematician, or require an undue allotment of time for other pursuits. Nothing can be more injurious to the extension of practical science than claiming for it too much devotion, and demanding for its cultivation time which cannot be applied without the sacrifice of matters of higher moment; but its adequate cultivation requires no extensive laboratory, no costly observatory, no expensive apparatus; nor, more costly still, no wasteful expenditure of time. It demands but the devotion of the "horæ subsecivæ," those hours of rest which may thus give healthful exercise to the mind as conducive to its well-being as to that of the body, and that change of occupation which gives repose to faculties previously employed; and I can conceive an agricultural people could have no greater blessing bestowed upon them than a taste for such pursuits. They have the necessary periods of rest from labour. The time of storm and tempest—the hours of darkness too early for repose—the time when nature causes all vegetable life to sleep beneath her winter mantle of frost and snow—these are times when principles may be learned, when knowledge available for future application may be stored up. As the summer yields its fruits for our winter's stock for the body, so might winter give for the wants of summer its supply of mental food, to keep alive the lamp of intellect and knowledge during the period of bodily labour. "Oh, fortunati nimium suæ si bona norint agricolæ!" would be truly applicable to such a people so employed, whose hours of bodily toil were refreshed by mental culture, and whose intellectual labour gave new sources of power and happiness to the body; and to you, the guides and guardians of the people, the task and the duty of striving after such a combination is committed. Governments may foster and encourage, but the formation of the taste to appreciate such aid must first originate in your example and your encouragement. As the Roman senate of old translated the works of their Carthaginian rivals on the science of agriculture, and gave them to her patricians to spread amongst their people, so the aids of instruction which our Government affords must, through your instrumentality, and by your first taking advantage of them, find their way amongst all classes of our people.

I shall now proceed to direct your attention to a few special applications of physical laws to practical purposes, and, as briefly as possible, tax your time and patience by referring to a very few cases, many of them, perhaps, familiar to you, but which I bring forward to show how important, in the pursuits of agriculture, may be the correct knowledge of abstract scientific laws, and I shall adduce a few examples illustrative of these applications.

A knowledge of the principles of mechanical science is of such obvious importance in its practical application that this branch of our subject would seem to need but a transient glance; but how frequently are its practical applications marred by ignorance of the principles on which it is based? No one who is at all conversant with this subject but is well aware how frequently machines have been and are constructed to effect economy of labour and animal power, but, from ignorance of the laws of mechanic forces, of such ill-judged construction that they either waste the power employed or absolutely resist it. The construction of the primary machines used in agriculture, the cart and the plough, have, from ignorance of mechanical principles, been, I may say, for ages the reproaches of civilization, and it is but in modern times that correct views respecting their construction have obtained amongst our manufacturers. In remote parts of Ireland at the present day we see lamentable ignorance on this subject still prevailing, in the construction of even wheeled carts; and a few years since in the north-west, in Donegal, many carts were employed which did not even boast of the innovation of wheels, but were dragged along the ground on the ends of the shafts. The position of draught for these primal implements, the angular direction in which the horse's force is most advantageously employed, is a proposition of purely abstract character, and is found to depend on a few simple conditions, easily ascertained. The economic application of the windlass, the pulley, the inclined plane, and the various modifications of these powers, which much facilitate the application of animal force, are all within the province of this science, and need but little study to enable us advantageously to apply them. Thus far we have considered the personal and individual advantages of this study; when we take a wider view we see still further advantages accruing from it. All who reside in the country, and many who reside in town, are indebted to the labours of the surveyor and engineer in the construction of bridges, railways, drains, and waterworks; and he who is ignorant of the principles of these constructions must yield a blind acquiescence to the dicta of those who may be his equals in ignorance of the true principles on which such public works should be executed. The grand juror who presents for a road or a bridge acts but honestly to himself and those whom he represents in acquiring such knowledge as will guard him and them against having works undertaken without knowledge and executed without skill; and the same education will equally subserve his own individual interests if he construct a drain, or a house, or a cottage. Even in undertakings of more national importance, how great might the advantage of a controlling knowledge have been when railroads with impossible gradients or impracticable curves were brought before the public as useful investments for capital, and how many of such undertakings would have failed in involving their victims or their dupes had knowledge of true principles been as widely spread as the desire for their scrip? In a past age the perpetual motion had its promoters and its victims, whilst this has those of a locomotion, only perpetual in its demands for deposits and applications for new calls.

Did I not fear trespassing too much upon your time, there are many special applications of this branch of science I should gladly lay before you, especially referring to the many agricultural implements which the manufacturing skill of our peasantry could execute had they only correct principles to guide them. In proof that the skill is not wanting, we need but remember that the most elaborate and perfect instrument that was ever made for astronomical purposes was constructed in a remote part of the country by native workmen, under the guidance and direction of one whose name sheds lustre on the land of his birth, and who has gained for our empire an European fame. Of the mechanical application of air and water, those most economic prime movers, I cannot now allude to further than to point out how rarely are those elements judiciously employed in this country, and how frequently ignorance of the true principles of application compels the substitution of a prime mover, costly, and, for this reason, unadapted to the necessities of such a country as this. In speaking of the mechanical properties of air, I cannot but allude to that valuable property so beautifully applied in the barometer, an instrument of such great and acknowledged utility to the farmer. By the indications of this instrument he can, in innumerable instances, foretel the coming storm and rain, and thus protect himself from their ruinous consequences; and I do not think any scientific farmer who notes the prophetic changes of this invaluable instrument but may, in innumerable instances, guard himself against those casualties which so frequently blast the most hopeful anticipations of profitable return for his patient labour.

Of the application of the physical laws of heat I must say a few words—this prime mover of organic life, performing so essential a part in all agricultural operations. We at first view might suppose that we needed no instruction in the economic employment of this agent; that we could neither control its excess nor guard against deficiency, and yet we will find that we have it in numerous cases under our control, and that by a knowledge of the laws of its transmission, diffusion, and effects when in combination, we

can produce most valuable results in our agricultural and domestic management. The value of drainage is fully recognised; few soils but are susceptible of being largely increased in value by the process judiciously performed; and land previously valueless and incapable of producing cereal crops may, by this process, become fitted for the growth of the valuable stores of food. How does drainage effect this? The changes produced act in a variety of ways, many of them probably well understood; there are a few of them, however, to which I will direct your attention. By drainage we prevent the accumulation of surface water in a soil which, as long as it is retained, prevents those rapid transitions of temperature which should at the changes of the season affect the soil to some distance below its surface; and surface water effects this in consequence of an important law of nature, namely, that water is almost a non-conductor or transmitter of heat when the heat is applied from above. When the land is well drained, the interstices of the soil being filled with air, there is a constant interchange or current of air from the ground to the surrounding air, by which not only is its temperature kept equal, but there is a supply kept up of those chemical elements so essential in vegetation. That the drainage of land affects its temperature essentially is manifest when we inspect an ill-drained field in harvest time. We will find the crops fully ripened when the soil is drained, and green and badly developed when the drainage is imperfect. In another respect effective drainage acts most advantageously in admitting the winter's frost to penetrate the soil, the agency of which on all soils is of such acknowledged efficacy. In swampy ground, when the winter's frosts commence, the soil acquires a superficial crust of ice, but, water being as bad a conductor of cold as of heat, the action of the frost is limited to the surface. If the land be well drained the cold air penetrates the soil, and freezing the interstitial water contained in it, this expands with enormous force, producing that disruption and disintegration of the soil so beneficial and oftentimes so essential to rapid vegetation. Many other important results of drainage on the chemical development of plants I must omit for want of time. Whilst speaking of this subject, I cannot but allude to the invaluable aid afforded to the scientific agriculturist by the thermometer. On its numerous applications I cannot now dwell, but there is one important fact may be observed, by which it is well worthy of attention, namely, the highest and lowest temperature during the twenty-four hours, and those diurnal variations which may vary in contiguous portions of the same country, owing to the state of planting, draining, altitude or contiguity of sea or mountain ranges; by the same instrument we are enabled to ascertain the mean annual temperature, which may prove a great value in deciding the suitability of particular localities for certain crops. We know from observations made with this instrument that in climates of extreme winter's cold many sorts of cereal crops will perfect their seed, as in Poland, on the shores of the Baltic, and in high latitudes in Russia, though their winter is far colder than any we ever experience; but this is due to their mean summer's heat being as high, or higher, than we experience. We know that where the mean annual temperature is 59° maize will require six months to ripen, whilst with a mean temperature of 81° it requires but three months. I shall not trespass upon your time by adducing further proofs of the numerous applications of this invaluable instrument. There is another important law connected with the subject which should be borne in mind, as it is of great and general practical importance. We all know the mischief that arises to all vegetation, but especially to tender plants, during calm, clear nights, in spring, and even in summer. Now, this arises from a law of diffusion of heats, from which we infer that heat is constantly passing off radiantly from all bodies, and that when matter parts with its heat it receives from contiguous matter an equivalent quantity sufficient to maintain an equilibrium of temperature. In clouded states of the atmosphere the heat given off from the earth is reflected back from the clouds, but on calm and clouded nights the heat is lost by passing into space, and consequently the soil attains a temperature several degrees below that of the adjacent air, and even in summer frequently undergoes such a reduction of temperature as to produce a slight frost, while the temperature of the air is in many degress above the freezing point. In the plains of Mexico and India this is practically applied in producing artificial ice in climates where the normal production of it is unknown. Now, this frigorific effect of radiation being well understood, the remedy or means of guarding against its injurious effects becomes equally intelligible, and we at once can understand the reason why a slight opaque screen, interposed between the earth and the sky, effectually protects the former against its effects, and hence a slight covering of paper or calico will effectually preserve delicate plants from the frosts that occur in early spring, and which are due much more to radiation than the reduction of atmospheric temperature; even smoke will have the same effect, and the North American Indians have been said to employ this property in protecting their maize-fields from loss of heat from this cause, being in the habit of lighting to the windward of their plantation fires of green wood, the smoke of which spread over their fields serves as a curtain to retain the heat of the ground, and in this way guard against that reduction of temperature so destructive to growing crops; and in Belgium it is well known potatoes are protected on a similar principle from those early frosts which exert such destructive effects on the germination of this plant; and I feel convinced that large frames covered with calico might be even with the greatest economy applied in this country to produce the same effect with many of our early vegetables. In many cases nature supplies, by her own beautifully-adapted laws, protection based on the same principle. We have all observed those mists, which are generally supposed to rise from the earth after a bright day of sunshine, succeeded by a clear evening. Now, this is due to the radiation taking place immediately after the sunset, producing a reduction of the temperature of the earth below that of the adjacent air, which is consequently reduced in temperature, and deposits in a haze or mist those watery particles with which it had become charged during the day, thus serving the double purpose of shielding the earth from an undue degree of cold, and restoring to it the moisture which it had lost during the heat of the day. There is another fact of importance respecting radiation, which is, that even the colour of the surface has a most important effect in regulating its amount, the quantity increasing with the darkness of the surface. For this reason a dark peat soil will become colder on a clear night than one of a light colour, and this may be, perhaps, one reason why the valleys of the Rhine and Moselle are fitted for the production of the vine, the light-coloured and rocky soils not becoming unduly chilled by radiation during the autumnal period when frosts are so prevalent, and produce such palpable effects on dark and loamy soils. As radiation or evolution of heat is regulated by the state and colour of the surface, so do these causes likewise materially affect the quantity of heat which soils will absorb during the hours of sunshine; and we may lay it down as a general law that in proportion as a surface has a power of radiation, so has it a power of absorbing heat; and the variations of absorbtive power extend also to colours, white absorbing much less heat than dark colours, and this cause producing variations of heat in soils from 111 to 116, or 5 degrees of difference in light and dark coloured soil. This fact may, in many cases, be most usefully applied, as we can, by bearing this fact in mind, produce in melon-pits and conservatories a great increase of solar heat by fitting linings, and also, by reference to the same laws, preserve the heat so accumulated during the night. Did time permit I might make many allusions to the importance of a knowledge of these laws in many departments of domestic economy. The warming and ventilation of our buildings, subjects so ill understood and wretchedly administered, through ignorance of first principles; the economy of fuel in different agricultural operations attainable by knowledge of the laws under which the ordinary evaporation of water takes place;—these, and many other important applications, I must pass over without notice, and at once make one short allusion to the importance of the study of the laws of electricity, which is valuable from the results which may be expected from this study more than from any practical knowledge we have as yet derived. There can be no doubt that an agent of such universal diffusion, and playing such an important part in various atmospheric phenomena, as the aurora and the thunderstorm, must have some effect on vegetable physiology. We know perfectly well that on many occasions lightning palpably produces most energetic effects upon vegetables; but constant observation and experiments can alone enable us to arrive at the slow and almost imperceptible agency of this element upon vegetable and animal life. I did intend to pursue this subject farther, and notice how much science might be indebted to those who reside in localities where observations on this subject are possible, which might enlarge the domain of science, by the simple collection of facts, but having already, I fear, trespassed too far on your time, I will conclude, thanking you for the patience, and apologizing for the cursory and imperfect manner I have been obliged to bring this subject before you. I trust, however, that I have shown the practical importance of some branches of physical science to the agriculturist. Few sciences deserve more attention, and few will give more substantial rewards, both to the mind and to the body. Before I conclude, allow me to refer to one source of pleasure afforded by this study. In many most essential branches of knowledge, in all those grounded upon moral evidence, and the truth of which admits of degrees of proof, there must be, according to the constitution of men's minds, according to their position, circumstances, and habits, different amounts of conviction, and consequently unceasing doubts and endless grounds of discussion, and though as truth exists on all subjects, and its power must ultimately triumph, yet may the process give rise to many a mental struggle, and many a painful contest, by which alone the perception of moral truth can be obtained; but in the sciences to which I have directed your attention we have the high source of gratification that in every step we take in advance we tread upon ground firm and unyielding; every fact we observe is a truth, every correct inference a conviction; and in studying the laws and applications of physical science we are reading God's epistle to mankind, written in characters so clear and so convincing to the mind, that we feel we are partaking in some degree of some particle of the divine essence, with whom all is light, truth, and knowledge, and in the dissemination of these sciences we are aiding in a work which, when rightly understood, cannot but advance man's highest destiny.

INSTITUTION OF CIVIL ENGINEERS.

At the meeting on Tuesday, April 17, 1849, a paper was read "On the Application of Certain Liquid Hydrocarbons to Artificial Illumination," by Mr. C. B. Mansfield, B.A.

The following is a condensed abstract of this important paper:—

Liquid hydrocarbons have been comparatively little used, hitherto, for the production of artificial light; and, in the instances in which they have been applied to this purpose, their liquidity, and not their evaporability, has been turned to account.

In the use of common volatile oils, the excess of carbon in their composition is the great diffi-

culty; but, that difficulty once surmounted, the excess of carbon becomes an actual benefit.

There are two methods of rendering this carbon efficient as "light fuel," if advantage is taken of the volatility of the substances. One of these methods is to cause the vapour, as it escapes from a jet, to mix rapidly with the air; the other, to mix the vapour, before combustion, with other gaseous matters containing less carbon. The adoption of the first of these methods has been instanced already in Holliday's recently-patented naphtha-lamp.

The principle of the second method admits of two different adaptations, namely, the hydrocarbons may be mixed with some inflammable fluid containing only a small proportion of carbon. The ingredients of the mixture most accessible in this country are wood spirit and a volatile oil from coal naphtha, in the proportion of two thirds of the former to one third of the latter. (The author illustrated the illuminating power of this compound by means of a lamp which was burning on the table before him, and which gave a beautiful white light.) Any deviation, either way, from the proportion indicated will result in the production of a flame of inferior quality, and either pale or smoky, according as too much or too little of the wood spirit or the naphtha oil has been used. On the Continent they use a mixture of alcohol and oil of turpentine.

The other adaptation of the same principle (and that which it is the chief object of the paper to describe) is the dilution of the hydrocarbon vapours with permanent gases of inferior or even of no illuminating power.

This application may be called the naphthalization of gas, or the gasization of naphtha, according as its main object is to enhance the services of the gas, or to utilize the liquid: the latter is the object of the author's new process. The former has been already accomplished by preceding inventors.

The first invention of the kind was that of Mr. Donovan in 1830, who proposed to confer illuminating power on gases that are inflammable, but not luminiferous, by charging them with the vapour of hydrocarbons; but, from the want of a sufficiently volatile fluid, he was compelled to have a reservoir close to every burner. The next application was that of Mr. Lowe, who increased the light obtained from coal-gas by passing it over surfaces of naphtha. The next was Mr. Beale's air light; the object of this was to use hydrocarbons for illumination, by passing a current of air through vessels containing those liquids. This plan met, however, with the same obstacle as that of Mr. Donovan, viz., the want of a sufficiently volatile fluid.

This difficulty has been solved at length by the discovery of a liquid hydrocarbon as volatile as spirits of wine, but containing sufficient carbon for the most perfect light, and obtainable in any quantity. This hydrocarbon is procured from coal-tar, and called "benzole." Its volatility is such as to enable it to naphthalize atmospheric air as effectually as ordinary naphtha does coal-gas.

The system proposed by the author (and which was illustrated in the room by a working apparatus) consists in conducting a stream of almost any gas, or even of atmospheric air, through a reservoir charged with benzole, or some other equally volatile hydrocarbon, the gas or air so naphthalized being then conducted, like common coal-gas, through pipes to the burners. The author stated that the system was applicable on any scale, from the dimensions of town gas-works to the compass of a table-lamp. In the apparatus exhibited a small gasholder, filled by means of a pair of bellows, supplied common air through pipes. The gases formed by passing steam over red-hot coke will also answer the purpose well, and it will depend on local circumstances whether this mode of generating the current may be preferable or not to the expenditure of the mechanical force necessary for driving atmospheric air through the pipes. Pure oxygen charged with the vapour will explode on ignition; accordingly this may prove a useful source of motive force. It is difficult, however, to form an explosive mixture of the vapour with common air. By decomposing water with the voltaic battery, naphthalizing the hydrogen with benzole, and burning it with the aid of the equivalently liberated oxygen, a simple light of intense power may be obtained. The new system is a great simplification of the ordinary system of gas-lighting, as no retorts, refrigerators, purifiers, or meters are required in it, and the products of combustion are as pure as those from the finest wax. It is to be expected that the elegance of the material and the simplicity of the apparatus will induce its introduction into buildings and apartments where coal-gas is not now considered admissible.

The apparatus and conditions necessary for the success of the method are a flow of cheap gas, or of air, driven through pipes by any known motive power, and a reservoir of the volatile spirit through which the main pipe must pass in some convenient part of its course; these pipes and reservoirs being protected from the cold. Though the liquid does not require to be heated above the average temperature of the air, yet, as it is liable to become cooled by its own evaporation, it requires an artificial supply of heat. This may be readily effected by causing a small jet of flame of the gas itself to play upon the reservoir; and by a simple contrivance, called a "thermostat," by which the flame is shut off when necessary, the temperature can be made self-regulating, so as never to rise above or fall below a proper degree. The cooling due to the evaporation will, of course, be inversely proportionate to the quantity of liquid in the reservoir. If atmospheric air is used as the vehicle for the vapour, the jet-holes in the burner, from which it escapes for combustion, must be slightly larger than those for coal-gas. (Some burners, contrived for the purpose of accurately adjusting the size of the orifice to the quantity of luminiferous matter escaping, were here exhibited and described. These burners are constructed in a manner that any desired quality of flame, from a non-luminous blue to a smoky, may be obtained simply by moving a part of the burner: there is a medium point at which the most perfect brilliancy of flame is arrived at.) These burners will answer equally well for coal-gas, though that material cannot, even by them, be made to evolve so white and pure a light as that from benzole vapour.

A gallon of benzole, of the degree of purity requisite for the purpose, will cost about two shillings and sixpence; to this are to be added the expense of the air current, and the interest of the original outlay on apparatus, which will raise the whole cost to about four shillings for the consumption of a gallon of benzole. One ounce of that liquid will give a light equal to four wax candles, of four to the pound, for one hour; one gallon will give the same light for about one hundred and twenty hours. One gallon of benzole may be considered equivalent to about one thousand cubic feet of coal-gas.

And finally, to produce one thousand cubic feet of gas, at least two hundred pounds of coal must be transported, whereas one gallon of benzole weighs no more than seven pounds; this, in carriage, gives benzole an advantage of twenty-eight to one over coal as a source of light.

In the discussion which ensued, high encomiums were passed upon the talent and patient labour exhibited by Mr. Mansfield in the investigation of this important subject, which promises to lead to most remarkable results, as an extension of gas-lighting to positions where it has not before been considered applicable.

George Kennington, of Warkworth, Northumberland, civil engineer, for certain improvements in locomotive, marine, and stationary steam-engines; and in hydraulic and pneumatic engines. Patent dated April 17th, 1849; six months.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ERRATUM.—Page 312, 3d column, lines 39, 46, 68, and 70, for *sebacic* read *stearic*.

REMARKS UPON ALBUMEN, CASEIN, AND FIBRIN.

By M. F. BOPP.

[*Concluded from page* 327.]

ACTION OF CAUSTIC ALKALIS UPON CASEIN, ALBUMEN, AND FIBRIN—(*Concluded*).

The refrigerated liquid, which, if the operation has been properly conducted, exhibits numerous groups of concentric needles of tyrosin, is evaporated until a pellicle forms on the surface. It is then left at rest for twenty-four hours, and at the end of that time treated with concentrated alcohol, which leaves a residue consisting usually of small granules formed of concentric plates and needles. This residue is leucin, with, perhaps, an admixture of tyrosin. Sulphuric acid mixed with alcohol is added to the alcoholic solution until all separation of sulphate of potass ceases. The alcohol is then expelled from the fluid by evaporation, and the sulphuric acid remaining in the solution precipitated by means of acetate of lead, the excess of lead being removed subsequently by means of sulphuretted hydrogen. Upon the evaporation of the filtered liquid a fresh portion of leucin separates. The tyrosin obtained by the process is separated from the leucin by recrystallization from water, and subsequent washing with a little cold water, the tyrosin being but sparingly soluble in that menstruum, though it dissolves rather readily in hot water. The recrystallized and washed tyrosin is now still to be freed from a certain brownish-red matter which adheres to it: this is accomplished by dissolving the tyrosin in a little hydrochloric acid, treating the solution with animal charcoal, adding to the mixture a quantity of acetate of potash corresponding to that of the hydrochloric acid used, and rapidly filtering, whereupon the tyrosin separates in a fine network of needles spreading through the whole mass of the fluid. The acetic acid serves to retain in the solution a small quantity of ash, which would adhere tenaciously to the tyrosin were this latter substance left to crystallize from a neutral solution. The tyrosin is now finally recrystallized once more from water; after this final operation it is found to possess a brilliant pearly lustre.

The leucin is separated from the last portion of tyrosin adhering to it by solution in a quantity of hot water sufficient to permit the tyrosin and a small quantity only of the leucin to crystallize out. The very minute quantity of tyrosin which, after this, still remains in the solution is then finally removed by precipitation with basic acetate, or, better still, hydrated oxide, of lead; the precipitant carries down equally the colouring matter and a little leucin, although a pure solution of leucin and tyrosin is not precipitated by basic acetate of lead. The lead is removed from the liquid by means of sulphuretted hydrogen; the sulphuret of lead formed seems to exercise a decolorizing action upon the leucin solution. Yet the liquid remains still yellowish. It is now evaporated in a retort until a pellicle forms on the surface, when it is removed from the fire and left to cool. Upon cooling it solidifies to a mass consisting of leucin, with trifling admixtures of impurities, from which it is freed by washing on a filter, first with cold water, subsequently with alcohol, recrystallization, and treatment with animal charcoal.

The action of the hydrochloric and dilute sulphuric acids upon leucin and tyrosin* induced

* Hydrochloric acid dissolves leucin and tyrosin without decomposing them; leucin and tyrosin may be evaporated with hydrochloric and dilute sulphuric acids at a temperature not exceeding 212° Fahr. without suffering alteration.

me to investigate the action of the same acids upon casein, albumen, and fibrin.

ACTION OF HYDROCHLORIC AND SULPHURIC ACIDS UPON CASEIN AND FIBRIN.

According to Braconnot, the action of sulphuric acid upon muscle, gelatin, wool, and legumin (vegetable casein), gives rise to the formation of leucin. Mulder, on the other hand, states that albumen, when subjected to the action of hydrochloric acid, is resolved simply into hydrochlorate and humate of ammonia.

This statement of Mulder I have found to be incorrect, for, upon boiling albumen (or either of the other substances) with from four to five times its weight of concentrated hydrochloric acid for six or eight hours, the greatest amount of leucin and tyrosin procurable from albumen, &c., is obtained; and this result is altogether independent of the admission or exclusion of air to the boiling mixture. The mass which Mulder erroneously considers to be a mixture of hydrochlorate and humate of ammonia is dissolved in hot water, milk of lime added to the solution, the mixture boiled for some time to expel the ammonia, and then with the greatest possible speed filtered through a linen bag. The lime which the filtrate holds in solution is precipitated with a little sulphuric acid, the excess of the latter being subsequently removed by means of acetate of lead, and the lead finally by means of sulphuretted hydrogen. Upon evaporation of the liquid filtered off from the sulphuret of lead a syrupy mass is obtained, which is kept standing at rest for several days; the leucin and tyrosin subside in crystals, and are separated from the syrup by alcohol of 0.845 sp. gr., in which menstruum the latter dissolves. The leucin and tyrosin are then finally separated from each other in the manner already described.

In another experiment I substituted for hydrochloric acid a mixture of this acid with sulphuric acid. After the separation of most of the leucin and tyrosin, the syrupy liquid was kept at rest for about two months. At the end of that time a large number of groups of crystals were found to have formed in the liquid; they were separated from the remaining mass by rapid trituration with cold water. They were found to consist chiefly of leucin, but contained besides some crystals of a new substance altogether distinct in its properties from either leucin or tyrosin, as the following comparison of the respective properties of the three substances will readily show:—

I. *Leucin* sublimes in woolly flakes without leaving a residue; it is readily soluble in water, in hydrochloric acid, and in potass; it is only sparingly soluble in absolute alcohol; it forms pearly scales, which are frequently grouped concentrically.

II. *Tyrosin* cannot be sublimed, as the action of heat decomposes it, with emission of a smell of burnt horn; it is sparingly soluble in water, and almost insoluble in alcohol; it dissolves readily in hydrochloric acid and in potass; it forms pearly crystals, frequently grouped concentrically, and remarkable for their extraordinary bulk when crystallized from water.

III. *The new crystalline substance* sublimes in woolly flakes, without leaving a residue; it is sparingly soluble in water, and almost insoluble in hydrochloric acid and in potass; it dissolves readily in absolute alcohol; it forms needles possessed of no particular lustre, and which, when crystallized in small quantities from absolute alcohol, are as remarkable for their extraordinary size as the tyrosin crystals deposited from aqueous solutions.

I obtained this new substance equally from fibrin, albumen, and casein, but in insufficient quantity for further examination.

PRODUCTS OF THE PUTREFACTIVE DECOMPOSITION OF ALBUMEN, FIBRIN, AND CASEIN.

When a mixture of either albumen, casein, or fibrin, with forty to fifty times as much water, is exposed to the atmosphere at a temperature of about 70° F., putrefaction ensues, and in the course of four or six weeks the albumen, casein, and fibrin are completely decomposed. Fibrin presents, moreover, this remarkable phenomenon, that at the end of a few days it dissolves in the water, and that the solution is coagulable by heat, like a solution of albumen. Upon the examination of the putrefied liquids I detected in them ammonia, leucin, tyrosin, valerianic and butyric acids, and a substance resembling benzoic acid.—*Annalen der Chemie und Pharmacie*, vol. lxix., p. 16.

EXAMINATION OF SOME KINDS OF COPPER.

By H. ONNEN.

Of the following analyses those of the red coppers show an amount of nickel and cobalt; tin, which is usually found in coins and commercial copper, was not met with in Chinese copper. Nos. II. and IX. contain a considerable quantity of iron, while in the white copper there is a small quantity of silver. The yellow kinds are alloys of zinc and copper, and the white either of copper and nickel, or copper, nickel, and iron. The presence of sulphur deserves attention. The kinds analyzed are characterized as follows:—

I. Chinese copper or packfong, consisting of a broad plate. It was exteriorly and upon the fracture of a whitish-yellow colour.

II. White copper or packfong; a ring, the colour of which was blackish externally and the fracture irregularly yellow.

III. A sample consisting of several irregular thin pieces, which had been broken off a cake of copper, of a beautiful red colour externally and on the fracture.

IV. Chinese copper, best kind, a semicircular smooth piece, externally and on the fracture of a beautiful red colour.

V. Chinese copper, second kind, a smooth semicircular piece, externally and on the fracture of a copper-red colour.

VI. Chinese copper, third sort, resembling the piece No. V.

VII. Chinese copper, best kind, a thin plate broken off a round piece, externally and on the fracture of a copper-red colour.

VIII. Chinese copper, second kind, a thick square piece, with granular fracture, and coloured blackish-red by the presence of oxide.

IX. resembled No. VIII.

The specific gravity of these samples of copper was:—

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
8.57	7.84	8.31	8.93	8.70	8.45	8.58	8.70	8.46

The analyses gave the following composition:—

	I.	II.	III.	IV.	V.
Silver	0.12	0.44	0.14	0.505	0.07
Copper	87.54	85.06	98.49	97.790	82.21
Iron	1.17	4.08	0.01	0.210	0.19
Nickel	11.48	9.49	1.19	1.350	0.71
Cobalt	0.44	1.16	—	—	—
Sulphur	0.10	0.49	—	—	—
Zinc	..	..	..	..	17.56
Lead	—	—	—	—	—

	VI.	VII.	VIII.	IX.
Silver	0.07	—	—	—
Copper	62.49	97.12	92.65	93.48
Iron	0.40	1.28	0.10	4.43
Nickel	0.74	1.84	2.11	0.46
Cobalt	—	—	—	—
Sulphur	..	0.30	0.06	0.47
Zinc	35.84	—	—	—
Lead	..	..	5.75	—

—*Journ. für Prakt. Chem.*, vol. xliv., p. 242, and *Chemical Gazette*.

ON CAPRYLON.

By M. G. GUCKELBERGER.

The results of all the experiments made on the deportment of the volatile acids of the series $(C_2 H_2)n + O_4$, in their combination with alkalis and alkaline earths upon dry distillation, afford just grounds for assuming that these acids are, with secession of the elements of one equivalent of CO_2, resolved into bodies which contain the remaining equivalent of the carbon, the whole of the hydrogen, and one third of the oxygen of the decomposed anhydrous acids, and that, accordingly, no carbonaceous residue is obtained in the process of decomposition. The results of the following experiments afford a fresh proof of the correctness of this assumption:—

Only a small number of the acids belonging to the series $(C_2 H_2)n + O_4$ have hitherto been examined in this respect. The products of acetic and margaric acids have been known for some time; those of butyric and valerianic acids have been described recently by Chancel. The results of my researches on caprylon which I give in the present paper will, perhaps, contribute to the elucidation of the history of this class of substances.

To the kindness of Professor Fehling I am indebted for the caprylic acid upon which I operated; the acid had been prepared from cocoa-nut oil.

The baryta salt used in my experiments was perfectly pure.

The decomposition which the volatile acids of the series $(C_2 H_2)n + O_4$ suffer does not, however, take place always in the simple manner indicated above; but in most cases we observe separation of charcoal and formation of divers volatile products, which point to a more complicated process of decomposition. Yet this complicated process may be nearly altogether avoided, as the results of experiments with caprylate of baryta have shown, if the operator distils, instead of the pure salt, a mixture of the latter with hydrate of lime in excess, and takes care to heat the mixture with the greatest possible speed through the whole of its mass.

Upon distilling caprylate of baryta at a temperature raised gradually to a faint red heat, I obtained a distillate consisting of water with acid reaction, and a yellow oil floating on the water, and emitting an odour like acetone. The retort contained a highly carbonaceous residue. At the end of some time white flakes separated from the oil; it was, accordingly, evident that the latter consisted of a solution of a solid substance in one, or probably several fluid ones. The large proportion of separated charcoal in the residue showed evidently that the decomposition had not taken place in so simple a manner as might have been expected. This led me to endeavour to find out a method by which to prevent the separation of charcoal, and, accordingly, to simplify the process of decomposition. The most favourable results in this respect I obtained by rapidly heating to faint redness over an open charcoal fire a mixture of half an ounce of caprylate of baryta with one ounce of hydrate of lime in a heated flat-bottomed retort. The operation occupied from twenty-five to thirty minutes; during the process the mixture emitted dense white fumes, which condensed in the cold receiver to a yellow oily fluid; after some time the fluid solidified to a yellow mass of the consistence of butter. Pressure between a great many folds of paper removed from this mass a dark yellow fluid, leaving a white crystalline mass. This mass fused at 95° Fahrenheit.

On burning it in the combustion-tube with oxide of copper the following results were obtained:—

0.3230 grm. of substance gave 0.9160 of carbonic acid = 0.2499 C., and 0.3830 of water = 0.0425 H.

which is equivalent in per cents. to

Carbon	77.39
Hydrogen	13.15
Oxygen	9.46
	100.00

As these figures correspond so nearly to the formula, $C_{15} H_{15} O = C_{16} H_{15} O_3 - CO_2$, I assumed the new crystalline substance to be the expected product of the decomposition of caprylic acid.

The difference in the experiment and calcula-

tion was, as I subsequently found, attributable simply to the presence of certain impurities, which washing with cold water and recrystallization with boiling alcohol sufficed to remove. The fusing point of the purified substance is at 104° Fahrenheit.

In a state of purity caprylon is perfectly white; in its crystalline structure it greatly resembles Chinese wax; it has no taste; its smell slightly resembles that of wax. It is lighter than water; in spirits of wine of 0.89 sp. gr. it sinks to the bottom; it is insoluble in water. When in a state of fusion, it floats on the surface of the water as a colourless oil. It is readily soluble in ether, and in the fatty and essential oils. In alcohol it dissolves copiously, even in the cold; recrystallization from boiling alcohol is accordingly attended with a not inconsiderable loss of substance. In boiling alcohol and wood spirit it dissolves in such quantities that the solution upon refrigeration solidifies to a papescent mass. From all these solutions caprylon crystallizes in fine needles of silky lustre. It fuses, as I have already stated, at 104° Fahr., but it is only at 100.4 Fahr. that it solidifies again to a radiated crystalline mass. At 352.4 Fahr. it boils and distils over without suffering decomposition.

The combustion of perfectly pure caprylon (purified by repeated recrystallization from alcohol) with oxide of copper and chlorate of potass gave the following results:—

I. 0.3280 grm. of substance gave 0.951 of carbonic acid = 0.2594 C., and 0.396 of water = 0.0440 H.

II. 0.3190 grm. of substance gave 0.9270 of carbonic acid = 0.2529 C., and 0.3838 of water = 0.0425 H.

		Calculated.		Found.	
				I.	II.
Carbon, 15 equivalents		90	79.64	79.08	79.37
Hydrogen, 15	"	15	13.27	13.41	13.23
Oxygen, 1	"	8	7.09	7.51	7.40
		113	100.00	100.00	100.00

Caprylon suffers no alteration by the action of potass. Nitric acid, even fuming, is without action upon caprylon in the cold; but at a temperature of 104° Fahrenheit nitric acid of 1.4 sp. gr. exercises a most energetic action upon that substance: dense fumes are evolved, which, when transmitted through water, impart to the latter an etheric smell; a dark yellow oily fluid is obtained, heavier than water, and almost insoluble in that menstruum; the nitric acid which adheres to it may, therefore, be readily removed by washing with water. The washed fluid has a burning, aromatic taste; it dissolves readily in solutions of the alkalis. Its solution in ammonia produces in solutions of salts of lead and silver yolk-coloured precipitates. The new silver compound undergoes very speedily decomposition, even under the air-pump; when gently heated it deflagrates. This substance is accordingly analogous to the one which Chancel produced from butyrone, by subjecting the latter principle to the action of nitric acid; it might, therefore, be called nitrocapryloic acid.

The quantity of matter at my command was unfortunately too small to permit experiments being made with a view to the solution of the question,—whether the acetones contain a number of equivalents divisible by two?

PROCESS OF EXTRACTING NICKEL AND COBALT FOLLOWED IN A MANUFACTORY AT BIRMINGHAM.

By M. LOUYET.

The ore employed in this manufactory is obtained from Hungary. It consists principally of metallic sulphoarseniurets, and contains generally six per cent. of nickel and three per cent. of cobalt. These proportions, however, vary.

The ore is mixed with a small quantity of carbonate of lime and fluor spar, and the whole heated to a white red in a reverberatory furnace; the mass fuses at this high temperature, and a slag is obtained floating on the surface, which is removed, and a fluid mass of metallic appearance; the latter is let out of the furnace by a particular aperture, and watered, in order that it may be broken into fragments with greater facility. It has been ascertained from experience that when the slag is of a dull colour it contains iron; but if its surface is black and brilliant it is free from it. The metallic mass is reduced to a very fine powder, which is then calcined at a bright red in a furnace, graduating the temperature so as to avoid fusion, and constantly raking it: a considerable quantity of arsenious acid is driven off. The air has free access to the mass, which becomes oxidized and diminished in weight. The calcination, which lasts for about twelve hours, is continued until no more white fumes are given off, and the residue is treated with hydrochloric acid, which dissolves nearly the whole of it; the liquid is diluted with water, and milk of lime and hypochlorite of lime (chloride of lime) added,* when a precipitate falls, which, after being well washed, is thrown away. A current of washed sulphuretted hydrogen, generated from sulphuret of iron and dilute sulphuric acid, is passed into the liquid until it is saturated; it is discontinued when some ammonia, added to a sample of the filtered liquid, gives a black precipitate; if there was not an excess of sulphuretted hydrogen the precipitate produced by ammonia would be green. The sulphuretted hydrogen causes a precipitate in the liquid; it is washed, and, as it is slightly soluble, a current of sulphuretted hydrogen is passed into the wash-waters. The precipitate is thrown away. The cobalt is then thrown down with a solution of hydrochlorite of lime. The precipitate, washed, dried, and then heated to redness, is considered to be oxide of cobalt, and part is sent in this state into the market; another portion is heated to a white red; by this treatment the oxide loses in weight, but increases in density; it is sold as protoxide of cobalt. The liquid from which the cobalt has been precipitated is treated with milk of lime, which precipitates the nickel in the state of hydrate; this precipitate is washed, dried, and heated to redness; it is then mixed with charcoal, and, by means of a strong heat, reduced to the state of a spongy nickel, which is employed in the manufacture of German silver. With respect to the oxide of cobalt, nearly the whole of it is consumed in the Staffordshire potteries. The oxide of cobalt thus prepared is remarkably pure.—*Bullet. de l'Acad. Royale de Belgique*, and *Chemical Gazette*.

ON SOME SALTS OF LITHIA.

By Dr. RAMMELSBERG.

One of the principal objects of the author in undertaking this investigation was to solve the question whether lithia is capable of forming with sulphuric acid and the earths and metallic oxides double salts like the other alkalis; for hitherto we had only certain information with respect to the combinations of phosphate of lithia with the phosphates of soda and alumina; but as regards the sulphates we merely possessed contradictory assertions. Thus Arfvedson, the discoverer of lithium, thought that he had obtained a combination of sulphate of alumina with sulphate of lithia; but, after C. Gmelin's experiments had proved the contrary, he convinced himself that the salt which he had considered to be lithia-alum was nothing more than potash-alum, derived from the potash contained in the alumina employed in preparing the salt. Notwithstanding, Kralowanszky, six years later, again described lithia-alum, and published an analysis, according to which it has exactly the composition of ordinary alum and its crystals the same form. From the description of these experiments, however, it by no means follows that such is the case; for the salt considered in the analysis to be sulphate of lithia was not submitted to any examination. Since the lithia-alum, according to Kralowanszky, is still more insoluble than the potash-alum, inasmuch as it is said to require 24 parts of cold water for solution, it must appear remarkable that this double salt does not crystallize with greater readiness. The author asserts that no such lithia-alum as that described by Kralowanszky exists, and that Arfvedson and C. Gmelin are perfectly right. He modified his experiments in several ways, both as regards concentration, neutrality, or acid reaction of the liquid, as also the temperature on evaporation; but never succeeded in obtaining a lithia-alum. Nor could the compound sought for be separated by the addition of alcohol.

The author endeavoured to prepare some new double salts of the sulphate of lithia with other sulphates; and used for that purpose the sulphate of magnesia, oxide of zinc, nickel, cobalt, manganese, protoxide of iron, and oxide of copper. Equivalents of the salt of lithia and the sulphate were dissolved, and these solutions crystallized either immediately or after the addition of a little sulphuric acid; in not a single experiment were there any distinct indications of the production of a double salt, but the individual salts constantly crystallized separately. The experience acquired in the course of half a year has led to the result that no similar double sulphates, such as we are acquainted with in the case of potash, soda, and oxide of ammonium, can be obtained with lithia.

The author has also submitted to a more careful examination the chemical relations of lithia, especially its combinations with phosphoric acid. With the exception of the above-mentioned double salt with soda, all our knowledge respecting the combinations of phosphoric acid and lithia is very poor, and entirely of a qualitative nature.

The ordinary (so-called tribasic) phosphoric acid forms with lithia at least three different salts, viz., that with 3 atoms of lithia, $3LiO, PO_5$; a combination of this and the salt with 2 atoms of lithia and 1 atom of basic water, $3LiO, PO_5 + (2LiO, HO)\ PO_5$; and, lastly, the salt with 1 atom of lithia and 2 atoms of basic water $(LiO, 2HO)\ PO_5$.

Triphosphate of Lithia, $3LiO, PO_5$, is obtained when phosphate of ammonia and free ammonia are added to an acid solution of the acetate of lithia, or when phosphate of ammonia is added to a neutral solution. It also separates when carbonate of lithia is heated with water and a slight excess of phosphoric acid, in which case the neutral phosphate of lithia remains dissolved. It forms a crystalline powder, dissolves in 833 parts of water at 54°, and does not fuse when heated; it gives with salts of silver a pure yellow precipitate both before and after ignition. It contains 1 atom of water of crystallization, which it parts with on ignition.

The Combination of Triphosphate and Diphosphate of Lithia is formed when chloride of lithium is precipitated with phosphate of ammonia. The crystalline precipitate contains no ammonia. It dissolves in 200 parts water; the analyses of it, however, show that it contains 3 atoms of water, of which two thirds escape at 212° and five sixths at 392°; so that half the diphosphate is then already converted into pyrophosphate.

In this salt the acid contains twice as much oxygen as the lithia; however, it must not be looked upon as a combination of 5 atoms lithia and 2 atoms phosphoric acid; but must be viewed as a double salt, $3LiO, PO_5 + (2LiO, HO)\ PO_5 + 2HO$, in which the one member contains 1 atom basic water in the place of 1 atom lithia, although no such separate combination is known. It corresponds, however, to the ordinary phosphate of soda. A similar double salt exists in the case of lime; it may be prepared artificially by precipitation, and is also contained in bones, $8CaO + 3PO_5$, *i.e.*, $2(3CaO, PO_5 +$

* The lime and hypochlorite of lime are added to precipitate the iron and arsenic; the hypochlorite, by peroxidizing the iron, admits of its being precipitated by the lime.

$(2CaO, HO)\ PO_5$, for it must necessarily contain 1 atom of basic water.

The Neutral Phosphate of Lithia, that is to say the salt in which the acid contains five times as much oxygen as the lithia, is obtained—1st, when the triphosphate is dissolved in a strong acid, the excess expelled, and the residue dissolved and set aside to crystallize; 2d, when carbonate of lithia is heated with excess of phosphoric acid, and the liquid, separated from the triphosphate, evaporated; and 3d, when a solution of neutral acetate of lithia is evaporated with phosphoric acid. It forms large readily soluble crystals, which deliquesce in the air; its solution has an acid reaction, precipitates salts of silver yellow, and chloride of barium only upon the addition of ammonia. When heated to 212° it does not decrease in weight, but at a higher temperature water is expelled, and at a red heat it fuses to a clear glass of metaphosphate of lithia, the solution of which immediately produces a precipitate in chloride of barium, and gives a white precipitate with salts of silver. It contains 18 per cent. or 2 atoms of water, half of which it parts with at 392°, being converted into pyrophosphate.—*Berliner Berichte.*

TANNIC ACID.

This acid ($C_{18}\ H_5\ O_9$), which is so diffused through various parts of plants, in some even accumulated in large quantity, is very often a companion to starch, or is accompanied by it. This tannic acid, on being boiled with dilute sulphurie acid, gives rise to the production of gallic acid and grape-sugar, which is partly converted into humic acid. Thus from

1 eq. of tannic acid, $C_{18}\ H_5\ O_9$ take
2 " of gallic acid, $C_{14}\ H_2\ O_6$ and there

Remain..... $C_4\ H_3\ O_3$

When water unites with this, grape-sugar is produced.

Tannic acid, on being exposed to oxygen, is converted into gallic and carbonic acids, the latter equal in volume to the oxygen absorbed. The four equivalents of the body represented as $C_4\ H_3\ O_3$, absorb eight equivalents of oxygen, and produce four of carbonic acid ($4CO_2$).

If, in addition to these facts, we bear in mind that, when powdered gallnuts are moistened with water, gallie acid, carbonic acid, and alcohol are formed, and that by destructive distillation gallic and tannic acid yield the same products, then it becomes probable that when gallic acid is found in a plant it is the product of the decomposition of tannic acid, effected without the co-operation of the plant. This decomposition may either produce nothing but grape-sugar by combination with water, or, when oxygen is absorbed, carbonie acid may also be disengaged.*

We learn from this fact that either gallic acid and grape-sugar, or gallic and carbonic acids together, are produced from tannic acid severally by the action of sulphurie acid and of oxygen; that in tannic acid as in salicin we may conceive the existence of grape-sugar, and that, therefore, tannic acid may be eonsidered as a combination of gallic acid and grape-sugar. This at least appears to follow from the analyses of tannic acid that we at present possess.

When either tannic or gallic acid is suddenly and strongly heated, it produces one or more equivalents of pyro-gallic acid ($C_2\ HO$). On being cautiously heated to 482° F., both tannic and gallic acids are converted into meta-gallic acid ($C_6 H_2\ O_2$).

This perfect identity of peculiar eompounds, produced by pyrochemic decomposition, especially in connection with the preceding properties, seems fully to establish the pre-existence of gallic in tannic acid.*

Tannic acid is subject to still another change, which is remarkable in a physiological point of view, viz., its conversion into apotheme. This change takes place both in and beyond the plant, and consists in a transformation of the constituents of tannic acid, which is attended by the absorption of oxygen and the disengagement of carbonic acid, without the co-operation of any organ of the plant.

This change is the cause of the brown eolour of barks containing tannic acid, such as Peruvian bark, that of the ehesnut-tree, willow-tree, oak-tree, cinnamon-tree, &c. The chesnuts themselves, when recently taken from the pericarp, appear white, but they soon become brown. The beautiful change effected in mahogany wood, by exposure to the air, is owing to the same cause.

In such barks, therefore, as give ready access to the air, tannic acid undergoes the same change as when a solution of it is evaporated in the air. It is converted into apotheme. The browner a bark is the less tannic acid it contains, for the acid has been so much the more converted into apotheme.—*From Mulder's Chemistry of Vegetable and Animal Physiology.*

THE MANUFACTURE OF ALUM.

Alum-works existed many centuries ago at Roccha, formerly called Edessa, in Syria, whence the ancient name of Roch alum given to this salt. It was afterwards made at Foya Nova, near Smyrna, and in the neighbourhood of Constantinople. The Genoese, and other trading people of Italy, imported alum from these places into Western Europe, for the use of the dyers of red cloth. About the middle of the fifteenth century alum began to be manufactured at La Tolfa, Viterbo, and Volaterra, in Italy; after which time the importation of Oriental alum was prohibited by the Pope, as detrimental to the interests of his dominions. The manufacture of this salt was extended to Germany at the beginning of the sixteenth century, and to England at a somewhat later period, by Sir Thomas Chaloner, in the reign of Elizabeth. In its pure state it does not seem to have been known to the ancients; for Pliny, in speaking of something like plumose alum, says, that it struck a black colour with pomegranate juice, which shows that the green vitriol was not separated from it. The stypteria of Dioscorides and the alumen of Pliny comprehended, apparently, a variety of saline substances, of which sulphate of iron as well as alumina was probably a constituent part.

The only alum manufactories now worked in Great Britain are those of Whitby, in England, and of Hurlett and Campsie, near Glasgow, in Scotland; and these derive the acid and earthy constituents of the salt from a mineral called alum slate. This mineral has a bluish or greenish-black colour, emits sulphurous fumes when heated, and acquires thereby an aluminous taste. The alum manufactured in Great Britain contains potash as its alkaline constituent; that made in France contains commonly ammonia, either alone, or with variable quantities of potash. Alum may in general be examined by water of ammonia, which separates from its watery solutions its earthy basis, in the form of a light flocculent precipitate. If the solution be dilute, this precipitate will float long as an opaleseent cloud.

If we dissolve alum in twenty quarts of water, and drop this solution slowly into water or caustic ammonia till this be nearly, but not entirely, saturated, a bulky white precipitate will fall down, which, when properly washed with water, is pure aluminous earth or clay, and, dried, forms 10.82 per cent. of the weight of the alum. If this earth, while still moist, be dissolved in dilute sulphuric acid, it will constitute, when as neutral as possible, the sulphate of alumina, which requires only two parts of cold water for its solution. If we now decompose this solution, by pouring into it water of ammonia, there appears an insoluble white powder, whieh is subsulphate of alumina or basic alum; and contains three times as much earth as exists in the neutral sulphate. If, however, we pour into the solution of the neutral sulphate of alumina a solution of sulphate of potash, a white powder will fall if the solutions be eoncentrated, which is true alum; but if the solutions be dilute, by evaporating their mixture and cooling it, crystals of alum will be obtained.

When newly-precipitated alumina is boiled in a solution of alum, a portion of the earth enters into combination with the salt, constituting the insoluble compound, which falls in the form of a white powder. The same combination takes place if we decompose a boiling hot solution of alum with a solution of potash till the solution appears nearly neutral by litmus paper. This insoluble or basic alum exists native in the alum-stone of Tolfa, near Civita Vecchia, and it consists in 100 parts of 19.72 parts of sulphate of potash, 61.99 basic sulphate of alumina, and 18 29 water. When this mineral is treated with a due quantity of sulphuric acid it dissolves, and is eonverted into the crystallizable alum of commerce.

These experimental facts develop the principles of the manufacture of alum, which is prosecuted under various modifications, for its important uses in the arts. Alum seldom occurs ready formed in nature; occasionally as an efflorescence of stones, and in certain mineral waters in the East Indies. The alum of European commerce is fabricated artificially, either from the alum schists or stones, or from clay. The mode of manufacture differs according to the nature of these earthy compounds. Some of them, such as the alum-stone, contain all the elements of the salt, but mixed with other matters, from which it must be freed. The schists contain only the elements of two of the constituents, namely, clay and sulphur, which are convertible into sulphate of alumina, and this may be then made into alum by adding the alkaline ingredient. To this elass belong the alum

* When tannic acid is present in leaves, it must disengage carbonic acid with absorption of oxygen. In this manner astringent leaves may actually take up oxygen and give off carbonic acid.

* Since the above was written, Mulder has established a much closer relation between the tannic and gallic acids than is indicated in the text. If tannic acid be digested in diluted muriatic acid at 212° for several days, in a tube from which air is completely excluded, it is entirely changed into gallic acid, without the production of any other substance. This observation has led to a new analysis of the tannic acid, from which the formula, $C_{28}\ H_9\ O_{17}$, has been deduced.

The change of the tannic into gallic acid ($C_7\ H_3\ O_5$, or $C_7\ H_1\ O_3 + 2HO$) is, therefore, represented as follows:—

	C	H	O
To 1 of tannic acid	28	9	17
Add 3 of water		3	3
And 4 of gallic acid remain	28	12	20

—a conversion which is very simple.

The action of sulphuric acid upon tannic acid, in the presence of the air, is to convert it into gallic acid, with the production at the same time of a quantity of ellagic acid and a blackening of the liquid. The ellagic acid is produced from the tannic through the influence of the oxygen of the air. Thus to—

	C	H	O
1 of tannic acid	28	9	17
Add 2 of oxygen from the air.....			2
	28	9	19
And deduct 5 of water .. .		5	5 and
There remain	28	4	14

—which are equal to two of ellagic acid, $C_{14}\ H_2\ O_7$.

The results of this research are very interesting, and are detailed in Mulder's *Scheidkundige Untersuchungen*, iv., p. 640, *et seq.*

slates, and other analogous schists, containing brown coal.

THE CHEMICAL TIMES.

SATURDAY, APRIL 28, 1849.

ON THE ADULTERATION OF COFFEE WITH CHICORY.

We have recently examined a number of samples of ground coffee, purchased from different grocers, chiefly suburban, at prices varying from 1s. to 1s. 8d. per pound. We have not found a single sample among them that did not contain a strong admixture of chicory, some as much as sixty to eighty per cent. This gross imposition upon the public has been practised so extensively of late that it is really time something should be done to check it.

We could never have believed that any man in his senses would venture to assert that the adulteration of coffee with chicory tended to *improve* the quality of the former; and little, indeed, were we prepared for the most extraordinary statement to that effect so flippantly made in the House of Commons a short time ago by her Majesty's Chancellor of the Exchequer. We have, however, since then had occasion to converse with a great many people upon the subject, and we find, indeed, that a strange delusion seems to prevail of the positive improvement made in coffee by an admixture of chicory. Now, we will willingly grant that the admixture of two or three per cent. of the latter substance to coffee may, though it certainly could never be said to improve the *quality*, yet improve the *taste*, of the coffee infusion. But any admixture of chicory to coffee in proportions exceeding three per cent. we maintain to be positively injurious. The properties of coffee are, in the most essential points, totally different from those of chicory. The latter substance undoubtedly possesses properties which render it very valuable as a therapeutic agent: it acts as a stomachic, depurative, and diuretic; at the same time, the torrefied root exercises an action upon the nervous system somewhat analogous to that which coffee and tea exercise upon it, with this difference though, that, whereas the two latter substances *cheer* and *refresh*, chicory *heats* and *excites*. The principle which Liebig looks upon as the especial nutriment of the nerves, *caffein*, is not found in chicory. The latter substance contains simply a bitter extractive principle, a saccharine matter, albumen, certain salts, inulin, and chlorophyle. Coffee, on the other hand, contains, besides caffein (the most important of its principles), volatile oil, fatty oil, extractive matter, mucilage, legumin, &c. Judge, then, whether it is at all likely that substances differing so widely in their composition should present any great analogy of properties.

The use of chicory, *as a substitute for coffee*, was introduced extensively into Germany by Napoleon's continental blockade system. The cultivation of the Cichorium intybus became an important branch of German agriculture, and still continues so, though to a much less extent than formerly. The torrefied, ground, and prepared root is even now called "German Coffee," and extensively used in Germany as an addition to coffee, but never in proportions exceeding five or ten per cent. to the *utmost;* nor do the Germans look upon it by any means as an *improvement*, as is clearly shown by the fact that it is never added to the coffee when visitors are expected to partake of that beverage. The chicory used on the Continent is greatly superior, moreover, to the article produced in England.

The wholesale price of chicory in England is about 6d. per pound, though the grocers charge exactly the double for it, if purchased by itself. When sold in admixture to coffee at 1s. 4d. or 1s. 8d. per pound, the chicory fetches of course these latter high prices. The imposition which is thus practised upon the public is of the gravest kind, and the loss to the revenue most serious.

We hope the Government will speedily take steps to check this evil, by imposing upon chicory the same burden of duty which coffee has to bear.

We shall have occasion to return to this subject.

FERMENTATION.

This term has been of late extended to several chemical operations besides those formerly included under it. The phenomena which it exhibits under these different phases, and the changes which it effects among the various subjects of its operation, are no less striking and mysterious in their principle than important in their applications to the arts of life. Fermentations are now arranged into twelve classes:—1. The alcoholic; 2. The glucosic or saccharine; 3. The viscous or mucous; 4. The lactic; 5. The acetic; 6. The gallic; 7. The pectic; 8. The benzoilic; 9. The sinapic; 10. The ammoniacal; 11. The putrid; and 12. The fatty.

Fermentation, in the most general sense, may be defined to be a spontaneous reaction, a chemical metamorphosis, excited in a mass of organic matter by the mere presence of another substance, which neither abstracts from nor gives to the matter which it decomposes anything whatever. This process requires the following conditions:—

1. A temperature from 45° to 90° F.
2. Water.
3. The contact of air.
4. The presence of a neutral organic azotized matter in very small quantity, and of a crystallizable non-azotized substance in considerable quantity.

The former is the ferment, the latter undergoes fermentation.

In ordinary chemical actions we perceive one body unite to another to form a new compound; or one body turn another out of a combination, and take its place, in virtue of a superior affinity. These effects are foreseen and explained by the intervention of that molecular force which governs all chemical operations, that attractive power which unites the particles of dissimilar bodies. Thus, also, in the ordinary phenomena of decomposition we perceive the agency of heat at one time, at another of light or of electricity; forces of which, though we are not acquainted with the essence, yet we know the exact effect under determinate circumstances. But fermentation, on the contrary, can be explained neither by the known laws of chemical affinity nor by the intervention of the powers of light, electricity, or heat. Fermentation reduces complex organic substances to simpler compounds, thereby reducing them nearer to the constitution of mineral nature. It is an operation analogous, in some respects, to that effected by animals upon their vegetable food.

With a good microscope any person may convince himself that ferment or yeast is an organized matter, formed entirely of globules, or of corpuscles slightly ovoid, from the three to the four thousandth part of an inch in diameter. Sometimes their surface seems to have a little tail, which has been regarded as a bud or germ attached to the mother cell. Whenever the fermentation begins the yeast does not remain an instant idle. These small round bodies become agitated in all directions, and, if the substance undergoing fermentation is mixed with an azotized matter, as in beer worts, the corpuscles become larger, the small tails get developed, and, on acquiring a certain size, they separate from the parent globule, to live by themselves, and give birth to new corpuscles.* In the fermentation of beer from malt this series of multiplications produces a quantity of yeast seven times greater than what was added at the commencement. Were the above ingenious speculations demonstrated with certainty we should be led to admit in all these phenomena actions truly vital, and a reproduction like that of buds in the vegetable kingdom. The existence of a vital force seems to be rendered probable by the fact, that in incomplete fermentation, such as that of fine syrup with too little yeast, the ferment loses its properties and powers. If, however, we add to the solution of pure sugar an albuminous substance, a caseous or fleshy matter, the development of yeast becomes manifest, and an additional quantity of it is found at the end of the operation. Thus with nourishment ferment engenders ferment. It is for this reason that a little fermenting must, added to a body of fresh grape-juice, excites fermentation in the whole mass. These effects are not confined to alcoholic fermentation. The smallest portions of sour milk, of sour dough, or sour juice of beetroot, of putrified flesh or blood, occasion like alterations in fresh milk, dough, juice of beetroots, flesh, and blood. But, further, and which is a very curious circumstance, if we put into a liquid containing any fermenting substance another in a sound state, the latter would suffer decomposition under the influence of the former. If we place urea in presence of beer-yeast it experiences no change; while, if we add it to sugar-water in a fermenting state, the urea is converted into carbonate of ammonia. We thus possess two modes of decomposition, the one direct, the other indirect.

Although yeast has all the appearance of an organized substance, it is merely by analogy that its multiplication by growth is assumed, for this is a phenomenon very difficult of experimental demonstration. When blood, cerebral substance, gall, pus, and such like substances, in a putrid state, are laid upon fresh wounds in animals, vomiting, debility, and death, soon supervene. The scratches from bones in putrid bodies have been often the causes of disease and death to anatomists. The poison in bad sausages is of the same class of ferments. In Wurtemburg, where sausages are prepared from very miscellaneous matters, as blood, livers, brains, and offal of many other kinds, with bread, meal, salt, and spices, fatal results from eating them are not uncommon. Death in these cases is preceded by the gradual wasting of the muscular fibre, and of all the like constituents of the human body; so that the patient becomes emaciated, dries into a complete mummy, and soon expires. The cadaver is stiff as if frozen, and is not subject to putrefaction. During the progress of the sausage disease the saliva becomes viscid, and emits an offensive smell. No peculiar poison can be detected by analysis in the sausages; but they are rendered wholesome food for animals by the action of alcohol, or by that of boiling water, which destroy the noxious fomes without acquiring it themselves, and thus decompose the putrefactive ferment of the sausages. When this, however, passes unchanged through the stomach into the circulating system it imparts

* M. Turpin, M. Cagniard Latour, M. Quévenne, and Professor Mitscherlich.

its peculiar action to the constituents of the blood, operating upon it as yeast does upon wort. Poisons of a like kind are produced by the body itself in some diseases. In plague, smallpox, measles, &c., substances of a peculiar fermentative nature are generated from the blood, which are capable of inducing in the blood of a healthy person a decomposition like that of which themselves are the subjects. The morbid virus reproduces itself, and multiplies indefinitely, just as the particles of yeast do in the fermentation of beer. The temperature of boiling water and alcohol applied to matters imbued with such poisonous secretions renders their poison inert. Many acids, chlorine, iodine, bromine, empyreumatic oils, smoke, creosote, strong decoction of coffee, have the same salutary effect. All these agents are known to counteract fermentation, putrefaction, and that dry wasting of organic matter called eremacausis, or slow combustion. It is most deserving of remark that the poisons chemically neutral or alkaline, such as those of smallpox in man, and of typhus ruminantium in cows, lose their baneful power when subjected to the action of the stomach; whereas that of bad sausages, which is acid, resists the modifying power of the digestive organs.

Alcoholic fermentation has been copiously discussed in the "Dictionary." I may here add that ammonia, being a product of that change in solution of pure sugar, proves the presence of azote in the yeast; and that sulphuretted hydrogen, being made manifest in the disengaged gaseous products, by their blackening paper imbued with acetate of lead, proves the presence of sulphur. The acid liquor accompanying yeast may be washed away, without impairing materially its fermenting power, while the acid so removed has of itself no such virtue.

Yeast, freed from all soluble matters by water, alcohol, and ether, contains, independently of ashes, carbon, 50.6; hydrogen, 7.3; azote, 15; oxygen, sulphur, and phosphorus, 27.1 in 100 parts. Viewed atomically, yeast bears a close analogy to albumen. Like albuminous matter, yeast takes a violet tint with muriatic acid, and it may be replaced as ferment by gluten. Caseum (the curd of milk) and flesh operate the same effect. All these fermentative powers have the same globular appearance in the microscope with yeast. When the activity of yeast has been destroyed by heat, &c., it can be restored by the positive energy of the voltaic battery, which causes its combination with oxygen. The best proportion of sugar and water for exhibiting the phenomena of fermentation is 1 of the former to 3 or 4 of the latter, and 5 parts of sugar to 1 of fresh yeast may be added; though, in the course of fermentation, 100 parts of sugar do not consume 2 parts of yeast estimated in the dry state. The quickest fermenting temperature is from 68° to 86°. A very little oil of turpentine or creosote, or of the mineral acids, prevents or stops fermentation completely; oxalic and prussic acids have the same effect, as also corrosive sublimate and verdigris. It has been known from time immemorial in Burgundy that a little red precipitate of mercury, when added to the must-tun, stopped the fermentation. All alkalis counteract fermentation, but when they are saturated it recommences. The first person who described the microscopic globules of yeast with precision was Désmazièrs, who arranged them among the mycodermes (fungus-skinned), under the name of mycoderma cerevisiæ. They have not the flattened form of the globules of blood, but are rather egg-shaped. One small black point may be seen on their surface, which, after some days, is associated with 3, 4, or 5 others. Their average diameter is from $\frac{1}{5000}$ to $\frac{1}{4000}$ of an inch. Sometimes more minute globules cluster round one of ordinary size, and whirl about with it, when the liquor in which the globules float is agitated.

Fresh yeast loses by drying 68 parts in the 100, and becomes solid, horny-looking, and semitransparent, breaking readily into grey or reddish fragments. With water it resumes immediately its pristine appearance. When fresh yeast is triturated with its own weight of white sugar it forms a liquid possessing the fluidity of oil of almonds, and a yellow colour. The globules continue unchanged, except perhaps becoming somewhat smaller. Yeast in the dry state retains its fermentative virtue for a long time.—*Ure's Supplement to his Dictionary of Arts, Manufactures, and Mines.*

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

John Wright, of Camberwell, in the county of Surrey, engineer, for improvements in generating steam and evaporating fluids. Patent dated November 12th, 1848. Enrolled April 12th, 1849.

The improvements described in this specification consist of a mode of generating steam and evaporating fluids, by the intervention of one or more series of tubular or cellular vessels, through which water or some other circulating medium flows, as the heat-communicating agent. A portion of the cellular vessels is exposed to the action of the fire, and the other portion is placed within the boiler or vessel containing the fluid to be evaporated. The fluid circulating in the cellular vessels carries off the caloric from the fire, and communicates it to the fluid to be evaporated. The specification is accompanied by engravings illustrating the adaptation of the improvements to an ordinary boiler for the generation of steam.

The patentee states he is aware that a somewhat similar arrangement of pipes or tubes has been employed already for the same purpose which his present invention is intended to accomplish; but he observes that in all the arrangements of the kind hitherto suggested the pipes are connected and secured together by screws and other similar appliances, whereas he employs cellular vessels for the purpose.

These cellular vessels the patentee purposes to make of what is called "malleable cast iron," or of copper, or some alloy of the latter metal. Or he proposes to make them from rolled or stamped corrugated plates, such plates being secured together by welding or rivetting, or by both these methods, in a manner to form the cells between them. If the vessels are formed of cast metal, the cells are cast in them, and the cores afterwards extracted.

When using cast iron as the material a flat cast is taken in the first instance. The cast is then annealed to render it malleable, and in that state it is bent into the desired shape.

The following is the arrangement of the apparatus:—

Extending beneath the boiler is a cellular vessel, formed of three longitudinal pipes or cells, and of a series of smaller transverse ones, which connect the longitudinal cells together, thus allowing a free communication between them. The vessel is curved to nearly the same curvature as the bottom of the boiler. Between the transverse cells of the vessel openings are made through, to allow the passage of the heated air and of the products of combustion from the fire to the flues. Within the boiler, and beneath the surface of the water to be evaporated, are placed two other cellular vessels, formed of two longitudinal pipes or cells, and connected by transverse pipes in the same way as the first. The ends of all the longitudinal pipes are made open, and, when affixed to the boiler, have curved pipes attached to them for the purpose of effecting a free communication between the cellular vessels.

The mode of action of the apparatus is as follows:—The caloric from the fire is taken up principally by the cellular vessel intervening between the fire and the bottom of the boiler; the products of combustion passing through the openings between the transverse cells of the vessel strike against the bottom of the boiler, pass onwards over the bridge, and descend through the openings in the after part of the cellular vessel, whence they proceed through the flues, in the ordinary manner, to the chimney. The principal part of the caloric resulting from the combustion of the fuel is thus taken up by the cellular vessel, and communicated to the water contained therein. The heated water ascends through the cells to the vessels within the boiler, where the caloric is given off to the water to be evaporated; the water then descends again to receive a fresh supply of caloric, and a free circulation of the heat-conveying medium is thus established.

To permit the expansion of water contained within the vessels, a suitable safety-valve is attached to a branch pipe at any convenient position outside the boiler setting; this valve is properly loaded, so as to allow any escape of water requisite. There is also a force-pump attached, to supply any deficiency arising from leakage, or from the contraction of the contained water upon cooling.

The patentee proposes also to employ within the cellular vessel, as a circulating and heat-conveying medium, other suitable fluids, or an amalgam of mercury.

He describes a modified arrangement of the apparatus applicable to marine steam-boilers, as also a mode of adapting it to locomotive engines. In this case there are employed several cellular vessels, ranged side by side, and above one another, the transverse cells being in a vertical transverse direction, but inclined in a longitudinal direction. The mode of action, however, is the same.

The patentee claims the application of the cellular vessels, as described, for the purpose of generating steam or evaporating fluids.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING APRIL 19TH, 1849.

Gaspard Brandt, of Little Gray's-inn-lane, in the county of Middlesex, machinist, for improvements in the construction of the bearings of railway engines, and railway and other carriages, now in use. Patent dated April 13th, 1849; six months.

James Childs, of Earl's-court-road, Old Brompton, waxbleacher, for improvements in the manufacture of candles, night-lights, and candle-lamps. Patent dated April 16th, 1849; six months.

Thomas Cocksey, of Little Bolton, Lancaster, millwright, and James Nightingale, of Breightmet, bleacher, for certain machinery to facilitate the washing and cleansing of cotton and other fabrics, which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizing warps and piece goods. Patent dated April 16th, 1849; six months.

Louis Prosper Nicolas Duval Piron, engineer, of Paris, for certain improvements in tubes, pipes, flags, kerbs for pavements and tramroads. Patent dated April 16th, 1849; six months.

Charles Shepherd, of Leadenhall-street, chronometer-maker, for certain improvements in working clocks and other timekeepers, telegraphs, and machinery by electricity. Patent dated April 16th, 1849; six months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, in the county of Lancaster, manufacturers, for certain improvements in looms for weaving. Patent dated April 16th, 1849; six months.

John Ruthven, engineer, Edinburgh, for improvements in preserving lives and property from water and fire; and in producing pressure for various useful purposes. Patent dated April 16th, 1849; six months.

William Henry Phillips, of York-terrace, Camberwell New-road, in the county of Surrey, for improvements in extinguishing fire; in the preparation of materials to be used for that purpose; and improvements to assist in saving life and property. Patent dated April 16th, 1849; six months.

William Little, of 198, Strand, in the county of Middlesex, for improvements in the manufacture of materials for lubricating machinery. Patent dated April 16th, 1849 ; six months.—(Communication.)

Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for the manufacture of net lace, or other similar fabrics. Patent dated April 16th, 1849 ; six months.—(Communication.)

William Hyde Knapp, of Long-lane, borough of Southwark, chemist, for improvements in preparing wood for the purposes of matches and firewood. Patent dated April 17th, 1849 ; six months.

Thomas Nicholas Greening, of the firm of Messrs. Burdekins and Greening, of Sheffield, cutlery-manufacturers, for improvements in knives and forks. Patent dated April 17th, 1849 ; six months.

Alexander Alliott, of Lenton Works, in the county of Nottingham, bleacher, for improvements in apparatus for ascertaining, and for marking or registering, the force or pressure of wind, of water, and of steam ; the weight of goods or substances ; and the velocity of carriages ; also in apparatus for ascertaining, under certain circumstances, the length of time elapsed after carriages have passed any given place ; and for enabling the place or direction of floating bodies to be ascertained. Patent dated April 17th, 1849 ; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in boilers or steam-generators. Patent dated April 17th, 1849 ; six months.—(Communication.)

Henry Bessemer, of Baxter-house, in the county of Middlesex, engineer, for improvements in the methods of extracting saccharine juices from the sugar-cane, and in the manufacture of sugar, as also in the machinery or apparatus employed therein. Patent dated April 17th, 1849 ; six months.

John Ormerod, of Holt Holme-hill, near Newchurch, Lancaster, spinner, for certain improvements in carding cotton and other fibrous substances. Patent dated April 19th, 1849 ; six months.

Robert Gordon, of Heaton Norris, in the county of Lancaster, engineer, for certain improvements in the ventilation of mines. Patent dated April 19th, 1849 ; six months.

N.B.—This patent, being opposed at the Great Seal, was not sealed till the 19th, but bears date the 4th April instant, the day it would have been sealed but for the said opposition.

Economy of Fuel. — Any new invention which is stated by competent judges to be capable of effecting a great saving of fuel, and an almost total consumption of smoke, has claims on the public attention and investigation. Such an invention, we are assured, is the steam-boiler furnace of Mr. H. F. Baker, of Boston, United States. Soon after its introduction into this country Mr. Wicksteed, civil engineer, at the request of the patentee's agent, made two long experiments upon three Cornish boilers, first, without the new furnace ; and secondly, the same boilers with the new furnace, using small Newcastle coals of inferior quality. From his details and results of these experiments we select a few which seem to exhibit great superiority in regard to the saving of fuel and the efficiency of action :—

	Without new Furnace. lb.	With new Furnace. lb.
Coals consumed per hour..	313	293
Water evaporated per hour	2.170	2.256
Water per lb. of coals from initial temperature	6.919	7.701
Water from 212° (latent heat 1,000)	7.725	8.640

The last line shows that, when taking the coals from the heap, 1lb. of coals with this furnace evaporated 11.8 per cent. more water than without. Mr. Wicksteed adds that :—"After this trial, which exhibits a saving of 118.10 per cent. of fuel in the Cornish boilers, I can have no hesitation in declaring that the saving of 37 per cent. upon the average stated to have been effected in the American establishments has been effected, and that there are numberless cases in Great Britain where a similar saving might be produced." Mr. Wicksteed says he had not a fair opportunity of testing the merits of this furnace as a smoke-consumer ; but, with one straight flue to the chimney, as in the American furnaces, he thinks, if a reduction of fuel were effected by introducing slow combustion generally, the average saving in our manufacturing establishments would be thirty per cent. of fuel ; and that "this would cause an annual reduction of smoke in proportion to the fuel ; but there is also no doubt that the reduction of black smoke evolved from the chimneys would be in a much greater proportion than the reduction in the quantity of coals, in consequence of the slow combustion." This furnace is said to have the further merits of cheapness of construction (causing a considerable saving in the first outlay upon new boilers and buildings), and of being cheaply adapted to any description of boiler already set. None of these furnaces being yet erected in Manchester, we are unable to say anything of our own knowledge respecting their merits, but we understand that there is one at the works of Messrs. Thomas Hoyle and Sons, at Dukinfield, which gives great satisfaction, both as to its economy of fuel, and its consumption of smoke. Mr. Graham, of that firm, has stated that the very careful experiments there made with this furnace would indicate a better result than any he had before obtained from any of the furnaces which he had experimented upon in numerous experiments on the evaporation of water, and on smoke-burning. Another of these furnaces is at work at the Broad Oak Print Works of Messrs. Hargreaves Brothers, at Accrington, and gives satisfaction there. We have seen a letter from the United States which states that these furnaces are being erected at the Washington Navy-yard, under the direction of the engineer-in-chief of the United States Navy, and that they are also to be placed at the other navy-yard (Norfolk, Virginia).

On the Magnetic Power of Mineral Substances.—It appears, from the researches of M. Delisse, that the magnetic power of the mineral substances which compose the crust of the globe varies according to their relative richness in iron, manganese, cerium, &c., or the magnetic metals. On the other hand, it diminishes in proportion as they contain a greater quantity of silica, alumina, lime, fluor, &c. ; that is to say, of substances in which the magnetic action is either null or very feeble—whilst, on the contrary, the diamagnetic action predominates. All the silicated or non-silicated minerals in which the iron is present in the state of oxide, which have a high magnetic power, contain at the same time protoxide and sesquioxide of iron ; but the converse does not always hold good. The minerals which readily become electric by heat, such as the tourmaline, &c., which have magnetic substances combined with them, possess a very slight magnetic power, and which appears to depend only on the proportion of the magnetic substances. The electrical and magnetic properties of a mineral thus appear to be independent one of the other.

Public Exhibition of Machinery at Ghent. We have been favoured with the copy of a royal decree issued by the King of the Belgians on the 23d of March last, to the effect that a special exhibition of machinery, frames, looms, and implements of trade (of Belgian or foreign make) employed in the manufacture of yarn and tissues of all sorts, shall be opened at Ghent (on the occasion of the exhibition of the produce of the industry of Flanders) in the month of July. It should be distinctly understood that the royal ordinance exclusively refers to "mechanical agents" properly so called, and not to motive or "transmissive" powers. Special rewards, consisting of commemorative medals, of gold, silver, and bronze, will be awarded to such exhibitors as shall appear to merit such a distinction. The Government reserves to itself the right of making the acquisition—as models, either for the immediate use of trade, or for deposit in the state collections—of any machines or implements presenting important improvements. Every facility of conveyance will be afforded to foreign exhibitors, and no import duties will be levied on the machines unless declared to be imported for use. Exhibitors must affix to each article a note explanatory of its use, as well as the price demanded. A notice of some days must also be given to the Minister of the Interior. Independently of the above exhibition, the communal fêtes of the city of Ghent, which will be very interesting to foreigners, will take place at the same time.

City Commissioners of Sewers.—On Tuesday, the 24th inst., a meeting of the commissioners took place in Guildhall. Mr. Deputy Peacock presided. After a motion by Mr. Deputy Lake, who complained of the state of the carriage-way in Leadenhall-street, had been agreed to, the surveyor put in the report on the practice of turning the contents of cesspools into the sewers, which was read, and ordered to be entered on the journals ; and a motion by Mr. Blake on the same subject was agreed to unanimously. Mr. Daw, the chief clerk, then read the report as to the supply of water, which, after some observations from Mr. Deputy Stacy and Mr. Blake, was also ordered to be entered on the journals. A number of tenders for the cleansing of the streets of the City were then received, and it was determined to refer the subject to the general purposes committee. Mr. Deputy Godson brought the subject of the whalebone-boiling in Aldersgate-street before the meeting, which, after some discussion, was, on the motion of Mr. Harrison, ordered to be referred to the committee of health. A communication from the secretary of the Great Central Gas Company was read, and ordered to be referred to the general purposes committee. Annexed to the letter was a document, said to be of much importance, but which was not read, and the court adjourned without deciding whether or not it should be published.

Births and Deaths in the Metropolis during the Week ending April 21.—The total number of deaths in the metropolis during the week ending Saturday last, according to the register of the Registrar-General, was 1,089, being an excess on the weekly average of spring of 126. Epidemic diseases show a large increase, being 248—an increase of 50 ; measles, scarlatina, cholera, and typhus have, however, scarcely exceeded the usual amount. The excess of mortality arises from hooping-cough, bronchitis, and phthisis. Cholera has been fatal only in one case, which occurred in Whitechapel ; the sufferer was a woman, aged 32. The number of births during the same week was 1,348. The mean temperature of the week was only 3.71.

The Cholera in Ireland.—We have just received the following alarming accounts from Dublin :—"In addition to the other calamities which have fallen upon the western provinces is to be added the fearful spread of pestilence. Accounts reached town this day (April 26) which state that the cholera is rapidly thinning the peasantry in Ballinrobe, in the county of Mayo, and that it has also broken out in great virulence in the workhouse of Ballinasloe, in the county Galway. A letter from the latter town, dated last night, says :—'The greatest consternation has prevailed here since morning in consequence of the appearance of cholera in one of the auxiliary workhouses, with which the town is crowded. Up to the present time we understand there have been no less than 87 cases, of which 22 have already proved fatal. The disease has now broke out in another of these workhouses, where 12 cases have already occurred, and two deaths. We fear that, humanly speaking, there is every probability of the malady committing fearful ravages in this town, there being no less than sixteen auxiliary houses crowded with paupers.' Extract from a letter dated Ballinasloe,

24th April :—'I regret to have to tell you that the cholera has made its appearance here, and the town is in a frightful state this morning. There were upwards of 20 new cases of cholera this morning. I hear more since; there were several deaths last night through the town; and in the vicinity persons are lying dead, and no one to bury them.'"

The Cholera in France.—The committee appointed to examine the credit of 500,000f. applied for by the Government to guard against the spread of cholera has decided in favour of granting the credit. M. Turck, in his report, says :—"The Asiatic cholera has existed for the last six months in France. It has attacked 14 departments, and fallen on 4,500 persons, 2,500 of whom have died. Amongst these latter many were affected with other maladies; in consequence, we have to hope that the average of the mortality will not augment, even in the departments where the cholera was most inveterate. It was far being so in 1832; at that period the cholera raged in 70 departments, and Paris alone lost 18,000 inhabitants. It is true that at that time it exercised its ravages for a whole year, but at the end of six months it had reached its greatest intensity, and then declined.—*Galignani's Messenger.*

Royal College of Surgeons.—The following gentlemen having undergone the necessary examinations for the diploma were admitted members of the college, at the meeting of the Court of Examiners on the 20th inst. :—Messrs. Edgar William Mayne, Hon. East India Company's Service, Bengal; John Frederick Pritchard, Portsmouth; Henry Edward Brameld, Swinton, near Rotherham; Augustus Law, Artillery-place, Finsbury-square; William Tidmas, London; John Cox Lynch, London; William Tomlin, Nottingham; Edwin Younge, Walesby, Lincolnshire; William Harrison, Bedford; Thomas O'Kearney Gordon, Cork; Christopher Antisell Allen, Dublin; and Henry Briggs, Halifax.

Apothecaries'-hall.—The following are the names of gentlemen who passed their examination in the science and practice of medicine and received certificates to practise on Thursday, April 19:—Frederick Deike, Hastings; William Matthew Sheppard, Fulham; Isaac Tucker, Westbury Leigh; John Clarke, Greenham, Berks; Phillip William Govett, Plymouth; John Higginbottom, jun., Nottingham; Thomas John Warburton, Betley, Staffordshire; Thomas Hutchinson, Camborne, Cornwall; James Denton Hulme, Leicester; James Newham, Lyme Regis; Edmund Whitaker, Bacup, Lancashire; James William Crow, Gorleston, Suffolk; David Morris Thomas, Cwmamman, Carmarthenshire.

The Cultivation of Flax.—We are glad to perceive that the sowing of flax in the Queen's County is speedily progressing; and that the farmers are beginning to appreciate the utility of this valuable crop. Those who have not already devoted a portion of their land to the growing of flax we would recommend to try the experiment even on a moderate scale; for the sowing season will continue up to the end of this month. There can be no doubt of the beneficial results that will accrue to those who take advantage of our suggestion. Contrasting the price of corn with that of flax, the figure is in favour of the latter. It has been ascertained that the flax of last year's growth was the most remunerating crop that had been sown in all parts of the kingdom. It met with a ready sale in Dublin, and at the flax-mills of the north, to which new conveyance is open by railway at small charges. The importation of the best Riga seed is very large this year, and the price not exorbitant. Our reporter, who had been through the Abbeyleix land, is preparing in that neighbourhood for the reception of flaxseed; Mr. Leigh's flax-mill is in rapid progress, and will be in full working order against the harvesting of the new crop.—*Leinster Express.*

The Tea Plant in America.—Our news columns have already spoken of the effort of Mr. Junius Smith to introduce the tea plant into South Carolina. We shall be glad if the attempt succeed; but, in the meanwhile, the exploit of introducing it is no such great and astonishing one as some of our contemporaries seem to think The wonder is, that we in the United States, so full of energy and quickness as we are in every speculative undertaking, had been so supine in this matter, allowing other countries in the New World to take the lead of us entirely. The tea plant was introduced into Brazil more than thirty years ago. As early as 1817 the travellers Spix and Von Martius described the 10,000 tea plants growing in the Imperial Botanic Garden at Rio, under the charge of Chinese cultivators, as well as the tea produced, which proved to be of a strong, "rather earthy, and rough" flavour. Even poor despised Mexico had the honour of anticipating us in the experiment of the tea culture. The late Lieutenant Ruxton, author of "Rough Notes of a Journey through Mexico," in 1847, found the plant growing in the gardens of the factory at Mapimi (a very out of the way village on the road from Saltillo Chihuahua), and was told that the leaves were "of very tolerable flavour." There will be no difficulty in cultivating the tea plant in the United States. The great desideratum will be to produce good tea at moderate prices."—*American Paper.*

Cork Fibre Mattresses.—A number of experiments to exhibit the power and utility of this invention, which was described some time back, took place at the City Swimming-baths, near the City Saw-mills, on the Regent's-canal, last week, in the presence of several officers of the Imperial Russian Navy, and Mr. March, of the Russian Consulate, and others connected with the shipping interest. Messrs. Thomas Paul and Co., steamboat-fitters to the Russian Government, who had prepared the seamen's bedding for the experiments, attended to conduct the experiments. The bedding, &c., of a seaman, rolled up cylindrically, according to the naval regulations, into a bundle of the diameter of eleven inches, and containing a mattress of the cork fibre weighing nine pounds, was found sufficiently buoyant to support above the water three persons who clung to it. A raft was then constructed with great expedition, with oars and mattresses of the cork fibre or cuttings, being about six feet in length and eight feet in width; upon this three of the company floated high and dry, and it was very apparent that it was capable of supporting many more. The efficacy of this invention, though severely tested, was fully proved. The Russian officers present expressed their satisfaction at the result of the experiments, and stated that it would prove very useful in those vessels of the Imperial Navy employed on the Circassian coast of the Red Sea, where shipwrecks are of frequent occurrence. Some further experiments with small bolsters, intended for emigrants, were also made, which proved that a very small quantity of the material would float a man, and enable him to escape drowning from shipwreck.

Consumption of Spirits in England.—A return moved for by Mr. Moffatt, M.P., shows that the gross total quantity of proof spirits distilled in the United Kingdom during the year 1848 amounted to 23,230,066 gallons, of which 6,046,171 were distilled from malt only; 16,944,189 from a mixture of malt with unmalted grain; 126,282 from a mixture of sugar or molasses with unmalted grain; 99,175 from sugar, and 13,709 from molasses. The total quantity of proof spirits entered for home consumption in the United Kingdom in the same year amounted to 22,234,379 gallons, yielding a duty of £5,517,084. The quantity of proof spirits imported into England from Scotland was 2,080,216, paying a duty of £814,751; and the quantity from Ireland, 1,029,802, paying a duty of £403,339. The quantities imported into Ireland from Scotland, and into Scotland from Ireland, in 1848, amounted, respectively, to 591,337, and to 38,102. The quantity of proof spirits permitted out of distillers' stocks in England in 1848 amounted to 5,363,584 gallons; the quantity of British brandy permitted out of rectifiers' stocks to 284,066 gallons; and the quantity of spirits of wine so permitted amounted to 277,146 gallons. The quantity of rum received into rectifiers' stocks in England, Scotland, and Ireland, amounted, respectively, to 121,408, 20,235, and 5,288 gallons. The quantity of proof spirits put into bond in 1848 was 11,206,270 gallons; and the quantity delivered, duty paid, direct from distillers' stocks, to 12,023,796 gallons. Lastly, the quantity of proof gallons of British compounds and spirits of wine permitted from rectifiers' stocks for exportation to foreign parts, under drawback, amounted to 31,929.

TO CORRESPONDENTS.

"W. S., Manchester."—The article on Vitrifiable Pigments is concluded for the present. We expect, however, some further information on this interesting subject from the same and other sources. An increase in the proportion of the fluxes would probably answer your purpose. The crystallized boracic acid is prepared as follows:—Dissolve purified borax (biborate of soda) in about four times its weight of water, and add sulphuric acid to the solution until the liquid acquires a distinct acid reaction. The sulphuric acid combines with the soda, and the boracic is deposited upon the refrigeration of the liquid, in a confused group of shining scaly crystals. Throw these crystals on a filter, and wash them with water, to remove the adhering sulphate of soda and sulphuric acid; purify the washed crystals by solution in water and recrystallization. Fuse the crystals in a platinum cruicble, dissolve the fused mass again in hot water, and recrystallize once more. The mode of preparing anhydrous sulphate of the peroxide of iron is as follows:—Dissolve a certain quantity (as much as you may require) of the transparent green crystals of copperas of commerce in their own weight of boiling water, acidulate the solution with sulphuric acid, and let the green vitriol recrystallize. Take of the crystals, 4 ounces; oil of vitriol, 3½ ounces; water, 1 quart. Mix, dissolve, and boil. Add to the boiling solution gradually, and in small portions at a time, 9 drachms of nitric acid; stir the mixture after each addition of the nitric acid, and keep boiling for a minute or two after. Evaporate the solution to dryness.

"P."—The pills alluded to are prepared as follows:—Take of compound squill pill, 20 grs.; calomel, 5 grs.; powdered opium, 3 grs. Mix, and form into six pills. Dose, one or two pills at bedtime. These pills are given as an expectorant; they act sometimes also as a gentle laxative.

"T. R."—Broken pieces of amber may be joined together by smearing the fractured surfaces with linseed or boiled oil, and then strongly pressing them together, holding them at the same time over a charcoal fire, or heating them in any other way in which they will not be exposed to injury.

"Chemicus."—We beg to decline.

"A Painter."—We can give no opinion on the subject.

"W."—We have not yet received an answer to our inquiries on the matter.

"A Brewer."—You will find the fullest information on the subject in the present number.

"Soda-water."—We should say the product may be utilized for any purpose to which sulphate of lime is applicable.

"A Tobacconist."—The term amadou is derived from the French, and is applied to a spongy, combustible substance, made from a species of mushroom which grows on the trunks of old trees.

"Mr. Miller."—Decidedly not. Let them try it.

"A Novice."—We are sorry we cannot assist you.

"Inquirer" is referred to No. 98 of the *Pharmaceutical Times.*

"A Kentish Druggist."—The chapter on Extracts in Soubeiran's Course of Practical Pharmacy gives the fullest instructions for the preparation of extracts. Next week's number will contain the formula for preparing Extractum Sarzæ. We quite agree with our correspondent on the subject mentioned in his letter, and shall shortly give a series of formulas.

"Inventor."—Most willingly. Send us the article for inspection.

"B. C."—We know no firm of the name of Bauerbächer and Co., at all events not in London.

ORIGINAL SERIES.

ON BENZOLE: ITS NATURE AND UTILITY.

A LECTURE.

By C. B. MANSFIELD, Esq.*

It is of a substance that I have to speak this evening,—of its actual chemical relations to other substances, and of its possible practical relations to some important purposes of economical life. Before introducing it, however, with all its habits and peculiarities, to an audience to whom it may be a stranger, I should apprize you duly of its birth, parentage, and education.

Benzole is a hydrocarbon spirit, one of the numerous offspring of the union of hydrogen and carbon, born (at least in its latest appearance, of which I have more particular occasion to speak, for it has had many birthplaces) in coal-tar; and redeemed from its native foulness by the civilizing process of distillation. In asking their attention to coal-tar, I must apologize to the gentler of my hearers, whom I cannot suppose to be in any way acquainted with so plebeian a material, for bringing it here before them; and perhaps I must plead guilty of wilful dishonesty in not confessing on my title that my subject would compel me to descant upon this unpleasant compound; but, feeling that no Englishman is bound to criminate himself, I did not think it necessary to announce my intended delinquency.

It is essential, then, to the appreciation of my subject that it should be understood what coal-tar is. It is a species of the genus tar, of the class bitumina. The name tar is applied to an easily-recognisable group of substances, some of which are natural and some are artificial. Of the former division, these specimens from Rangoon, from Barbadoes, and from Derbyshire are instances; of the latter, this beechwood tar, formed in the manufacture of acetic acid from wood, this pine-wood tar, commonly called Stockholm tar, and coal-tar, are examples. All these substances are characterized by a dark colour, black or brown, by a liquidity, or semi-liquidity, similar to that of treacle, by greater or less evaporability, by inflammability (when sufficiently heated), by oiliness, or insolubility in water, and by the solubility in liquid hydrocarbons, which belongs to all really bituminous matters. We feel compelled, by the similar properties of all these products, to class them together, although we do not know that they are of similar origin, and though their behaviour is in some respects sufficiently different to make it obvious that they are not identical species. All the tars which are produced in the arts are formed by the decomposition of organic matters, at heats about or above redness, usually in retorts, from which these products, being volatile, escape by distillation. But though many of the natural tars are found exuding from the earth in warm climates, or in districts which either are or have been volcanic, we have no evidence that a very high temperature has been concerned in their production; indeed the circumstances under which some of them are found seem to negative that conclusion.† Perhaps it may be correctly stated that tars are substances having the physical characteristics just now enumerated, that they are mixtures of various bodies, chiefly volatile hydrocarbons, resulting from the decomposition of organic matters under conditions of time and temperature, the limits of which are not yet ascertained. It may be suggested that their evolution is connected with a peculiar state of fermentation, which is rapidly induced in organic substances by great heat, but which may occur also more slowly under lower temperatures—a bituminous fermentation. This may seem the more probable when it is considered in how many chemical transformations time and temperature seem to be agents mutually replaceable,—convertible terms in the formula of operation. Mr. Grove recently reminded us here of the difficulty of forming a satisfactory notion of the one of these properties of matter: perhaps it is not more easy to perceive at once the correlation of the other with all the forces on which we are accustomed to speculate. Can it be that the only connection between these qualities lies in their verbal derivation? or does not rather the identity of their etymology imply a conception of a deeper harmony between these mysteries than can be realized by resting satisfied on a mere accident of nomenclature or on a superficial pun?

This coal-tar, then—the birthplace of my benzole—is formed by the bituminous fermentation of certain sorts of coal. It occurs in the formation of our common illuminating gas, its removal from which is the first process of purification to which the gas is subjected on its tortuous journey from the retorts to the burners. The coals used for this purpose are generally called bituminous; there are many varieties of them. Cannel coal and the common coal from Newcastle are instances of those which yield much tar, and to which the epithet "bituminous" is applied. This adjective, however, is to coal a misnomer, for these coals contain no bitumen. Here is a piece of bitumen—a solid species—an asphaltum from the western coast of Africa, near Ambriz, where it exudes liquid from the rock on the surface of the ground, and, its more volatile part evaporating, this brittle solid remains. It is like some coals in appearance, but the difference of its nature will be evident from a simple experiment. Here is a small quantity of benzole; the piece of bitumen is rapidly dissolved in the liquid, even cold, on which it confers its deep brown colour. Here again are two specimens of "bituminous" coal—cannel coal, and a rich, flame-burning coal from Newcastle: they are finely pounded in a mortar, to get them into the state most favourable for solution. I place the mixed powder, thus testing both at once, in this benzole, which I boil; you will see that the hydrocarbon, after this treatment, filters through paper almost as colourless as it was before; it has taken nothing into solution even after boiling; there was not a trace of bitumen in the coal. Not only is this bituminous coal not *bituminous*, but—*bituminiferous* as it is—it has not a whit more tendency to yield bitumen on decomposition than most other materials of organic origin. Equally from resins, wood, bone, fat, muscle, may be obtained by destructive distillation; all these substances are as copiously bituminiferous as the richest coal, but no human body but an Egyptian mummy would submit quietly to be called bituminous.

A negative assertion of what a subject is not ought, perhaps, in justice, to be followed by a positive statement of what it is; in the present case, however, this is unfortunately impossible. The nature of the substance in coal to which the gas and tar owe its origin is, I believe, quite unknown. It is very remarkable that, though chemists have assiduously analyzed and defined the various compounds which make up the great bulk of nearly all the material bodies within their reach, animal, vegetal, and mineral, we have been left quite in the dark as to what coal is. We know what it has been—an accumulation of vegetal organisms. We know that limestone is carbonate of lime, that woody fibre is a definite chemical compound, that muscle and sinew are made up chiefly of fibrine and gelatine, whose composition we know exactly; but we have no information as to what substances constitute the vast coal-beds with which our country has been blessed. We are aware that their mass is composed of the elements oxygen, hydrogen, nitrogen, and carbon, but of the compounds into which these elements are grouped in coal we have not even an hypothesis.

Now, though it is the ultimate analyses which are of practical utility in assigning their value as fuel to different sorts of coal, it is a knowledge of the proximate constitution of these materials which would be of interest to the chemist, which would enable him to assist the geologist in speculating on the circumstances under which vegetal fibre has been stratified into mineral masses, and which would give a double usefulness to the knowledge which we may obtain of the new substances which we procure by the decomposition of the coal itself. At present we can only look upon these latter products with an isolated interest, that which their own intrinsic worth may attach to them. The coke, the tar, the gas, the solid liquid and fluid products in which the coal lives again after its dissolution in the retorts, cannot be connected with the former bodies in which they existed in the coal by any intelligible scheme of metamorphosis. All we know is that the transmigration has occurred. The thread of consciousness, as it were, is broken; and we must rest content with what we can find out of the products we can actually see and handle, till we have attained by experiment to introvision into the retorts, or to intuition into the essence of coal.

Benzole, then, as a native of coal-tar, must stand or fall in our estimation by its own present merits, and cannot rest its claims to your attention upon any character it possessed in a former state in the coal-field. A fair judgment on it may be facilitated by a comparison of it with the other bodies which accompany it in the tar. In pursuit of this we must continue our consideration of this material. In the igneous decomposition of the coal this substance splits up into a great number of products, of which by far the larger number take their place in the tar, which, with the aqueous solution of various matters called the ammoniacal liquor, which is condensed with it, forms the liquid part of the result. It contains, also, entangled with it in solution, a certain quantity of substances, which, being usually aëriform, belong specially to the gaseous produce of the operation.

Coal-tar exceeds in weight most members of its genus; you will see that when poured into water it sinks at once to the bottom, while this natural tar from a coal mine in Derbyshire floats on the surface of the same liquid. The manner of its origin has already pointed out to us that evaporability is among its physical qualities: it may accordingly be distilled, and by thus treating it we obtain a further insight into its constitution. The result of this process at once shows us that it is not a single compound; and we find, in fact, that it is made up of a variety of substances which are mixed together in apparently inextricable confusion.

The distillation of this coal-tar is a branch of trade that is conducted on a large scale in many places; by this treatment it is separated into three distinct products as the operation proceeds—firstly, naphtha, or light oil, which you will see is lighter than water; secondly, "dead oil," which you will observe sinks in water, and which distils after all the naphtha has come over; and, thirdly, pitch, which remains behind in the retort, and which on cooling becomes this black solid mass. The pitch, too, if run off into retorts adapted for exposing it to a still higher temperature, may be farther distilled, for it consists chiefly of hydrocarbons volatile without decomposition; of them this wax-like solid paranaphthaline, and this remarkable yellow powder (which is the last product given off at temperatures nearly approaching redness), are instances. Some of these latter substances have boiling points higher than that of mercury, and it is possible that they might be conveniently used for thermometers, instead of that metal, for indi-

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* The substance of this lecture was delivered at the Royal Institution of Great Britain, on Friday, April 27, 1849.

† It is extremely probable that organic matters may be artificially converted into true tars without being subjected to heat. Aniline is formed in the fermentation of indigo, and benzole may be formed by passing the vapour of oil of bitter almonds over spongy platinum; the conversion, too, of animal fibrine into the oily substance, "adipocere," under certain peculiar circumstances, may throw light on this consideration.

cating higher temperatures than those which mercury will ascertain for us. When the pitch is thus treated there remains in the retort, as the result of a partial decomposition of some of its constituents, a beautiful coke of a cellular structure and extreme hardness, probably approaching as nearly to a pure carbon as any form of charcoal that we can obtain.

[*To be continued.*]

LECTURE ON ELECTRICITY AS A SOURCE OF LIGHT.

By THEOPHILUS REDWOOD, Esq.,
Professor of Chemistry and Pharmacy to the Pharmaceutical Society of Great Britain.

[*Continued from page* 261.]

In November, 1846, Mr. Staite took out a patent "for certain improvements in lighting," which consisted of a method or methods of maintaining an uniform distance between the charcoal points of an electric apparatus. The following is the most simple and efficient of the means described in the specification of this patent:—The charcoal electrodes are made to fit into two hollow brass cylinders, in which they slip up and down freely. The ends of the electrodes are supported on a solid cylinder of plaster of Paris, and are kept constantly in contact with this cylinder by a spiral spring within each of the hollow cylinders, which presses the charcoal down as the lower ends are destroyed by the action of the electricity. The ends of the electrodes may be made to touch each other by means of an adjusting screw, so as to close the circuit, and then to recede to any required distance. The current being established by bringing the electrodes into contact, the latter are separated so as to produce the required light; and it appears to have been thought that the distance from each other at which the charcoal points are thus fixed would remain unaltered. Such, indeed, would have been the case if the action of the electric current had merely caused a wasting or dissipation of the charcoal; but there is always an accumulation of the disintegrated particles about the points, which would soon fill up the intervening space, and destroy the required effect. Had this arrangement proved efficient its simplicity would have strongly recommended it for practical application. We are, however, justified in concluding that it has not proved efficient from the fact that, very shortly after enrolling the specification, the patentee took out another patent for further improvements in the method of adjusting the charcoal points. The second patent was sealed in July, 1847, and specified in January, 1848. In this patent a new principle was adopted for regulating the adjustment of the electrodes, which consisted in the use of an electro-magnet. "This part of the invention," it is stated, "is to impart, more surely, such motions to one of the electrodes of the apparatus that the light may be prevented from going out, be kept in a more uniform state, and be renewed by the action of the apparatus itself whenever it has been put out, provided always the electric current be maintained properly." A further improvement was again effected by the patentee a few months afterwards in the mechanical arrangement connected with the application of the magnetic power, and for this, and some supposed improvements in the construction of batteries, a third patent was taken out in July, 1848.

There are three distinct kinds of apparatus for producing light by electricity described in this patent. These are—

1st. The apparatus for producing a regularly intermittent light by electricity between charcoal electrodes, which is especially suitable for light-houses, and applicable for other purposes.

2d. The apparatus for obtaining a constant and uniform light with charcoal electrodes.

3d. An arrangement and apparatus for obtaining a constant and uniform light by the ignition of a metallic wire.

1. The apparatus for producing a regularly intermitting light consists of a frame with two charcoal electrodes above it; the electrodes are covered by a glass shade. The positive electrode is fixed in a metallic support, through which it is connected with the battery. The negative wire of the battery is coiled round a hollow cylinder so as to form a helix, through the centre of which a bar of soft iron passes freely. The wire of the helix is brought into contact with the iron bar, and the latter is surmounted by a brass rod, carrying the negative electrode; the lower part of this rod is cut with teeth, which work in a pinion fixed to the frame of the apparatus. A weight is attached to the brass rod by means of a string which passes over a pulley. This weight is intended to counterbalance the iron bar, together with the brass rod, and the charcoal (negative) electrode, and to keep the latter in contact with the positive electrode, when the apparatus is not in operation. There is a small chain extending from the weight to the stand beneath, a portion of which rests on the stand, so as to equalize the effects of the weight when the negative electrode is removed to some distance from the positive electrode.

The action of the apparatus would be as follows:—The two wires being connected with a battery of sufficient power, and the circuit closed by bringing the electrodes into contact, the iron bar becomes converted into a magnet, and is then drawn down into the helix. The electrodes are thus separated from each other so as to produce the greatest amount of light, but, the distance between them continuing to increase as the magnet is drawn further into the helix, the circuit is ultimately broken, the light extinguished, and the iron bar restored to its original condition. The weight now draws the bar and electrode up again until the latter comes into contact with the upper electrode, thus re-establishing the current, and producing a recurrence of the previous effects. It is obvious that a succession of flashes of light at regular intervals would thus occur, and by some modification of the mechanism the duration of the light and its intermission might be easily regulated.

2. The apparatus for obtaining a constant and uniform light with charcoal electrodes is more complicated than the preceding; but it is constructed upon a somewhat similar principle. The electrodes are placed as in the previous apparatus. The toothed part of the rod, to which the lower electrode is fixed, works into a pinion which turns on a spindle with fixed supports. A barrel is attached to the pinion, and a weight is suspended by a string which passes round and is fixed to the barrel, so as to counterpoise the weight of the rod and electrode. On the spindle of the pinion is fixed a wheel with square teeth. A lever turns on the same spindle, and carries a double paul, which works on a pin projecting from the side of the lever, so that the paul can lock into the teeth of the square-toothed wheel in either direction. A long horizontal lever passes over the paul from a joint or fulcrum, and this lever carries a light spring or tongue close beneath it, the end of which is kept from springing away from the lever by resting in a step in a little stirrup or fork, which is attached to the long horizontal lever, and embraces the square-toothed wheel and the lighter end of the paul. The paul and its lever are kept in a state of slow vibration from side to side by means of a crank which works in a fork at the end of the lever, the crank being made to revolve by an ordinary train of wheelwork furnished with an escapement or fly-wheel, and driven by spring power or weights: When the long horizontal lever is turned a little downwards, its tongue presses the lighter end of the paul into the teeth of the wheel, and the vibratory motion of the turning lever causes the lighter end of the paul to drive the wheel round notch by notch. This motion of the wheel causes the pinion to elevate the rack slowly, so as to raise the lower electrode towards the upper one. But when the long horizontal lever is raised or turned upwards, the notch in the stirrup lifts the tongue off the lighter end of the paul, and allows the heavier end of the paul to drop into the teeth of the wheel. This drives the wheel round in a contrary direction, so as to lower the rack and draw the lower electrode further from the upper one.

The end of the long horizontal lever is raised or lowered by a regulator coil, one end of the wire of which is connected with the upper electrode, while the other end is connected with the battery. An iron rod moves freely up and down in the central hole of the coil, and is prolonged upwards by a stem of wood, by which it hangs to the end of the long horizontal lever. This iron rod passes through a hole in the centre of a cap, which screws into the bottom of the coil-case. Around the rod there is a circular weight called an equilibrium weight, which rests on a small step in the rod when the latter is raised. When the rod sinks below its medium position, the weight is left behind resting on the edge or rim of the cap. The object of this arrangement is, that, when the rod is actuated by a force equal to its own gravity added to half that of the weight which surrounds it, it will have a tendency to return to its medium position, whether it be raised higher or carried lower than that position.

The mode of action of the apparatus is as follows:—The end of the negative wire of the battery is brought into metallic connection with the toothed rod, to which the lower electrode is attached. The positive wire is connected with the coil and the upper electrode. The circuit being closed, the current in passing through the regulator tends to raise the iron rod, which being connected with the long horizontal lever is counterpoised by a weight, which screws along an extension of the lever beyond the fulcrum.

To put the lamp into adjustment, the driving gear being wound up, and the battery in a fit state of activity, after closing the circuit, the long horizontal lever is raised by the hand until the electrodes have separated to the greatest extent compatible with obtaining a permanent light from them, and the weight is screwed backward or forward until it keeps the rod balanced, just so as not to sink below its medium position. There is also a contrivance by which, when the lever, influenced by the rod, is in the above position, the motion of the crank spindle is arrested, so that the electrodes remain stationary; but, if the lever should be raised or depressed, the crank revolves, and, giving motion to the arbor or paul, counteracts such effect. If the circuit should from any cause be broken, the rod, falling below its medium position, would depress the long horizontal lever, and give motion to the wheels by which the electrodes would be brought into contact so as to re-establish the current; and the current, causing the rod to rise into the coil, and the long horizontal lever to be elevated, would give motion in an opposite direction, so as to separate the electrodes to the distance for which the adjustment had previously been made.

3. The patented apparatus for obtaining a constant and uniform light by the ignition of a metallic wire is very simple. It consists of a loop or coil of iridium wire enclosed in a glass globe from which the air has been exhausted. There is nothing new in this method of developing the light, excepting in the substitution of iridium for platinum.

I understand that it has been more recently suggested to use platinum wire coated with iridium by means of electricity.

Such are the means proposed by Mr. Staite for obtaining light by electricity; but the public have hitherto had no satisfactory evidence of the efficiency of these means. I believe that in no instance has the light been exhibited without interruption for more than a few minutes.

Other means have been proposed and patented for the same purpose. In July, 1848, a patent was taken by Mr. Lemolt for certain improvements in apparatus for lighting by electricity. In Mr. Lemolt's apparatus for maintaining an uniform distance between the charcoal electrodes, the latter are made in the form of discs,

which are mounted on two arms, so as to admit of their revolving on their axes. The arms are separately fixed to an axis so as to move freely to or from each other. On the axis is also fixed a pinion which gears into a wheel, which is in communication with some moving power, such as eloekwork, within the frame of the apparatus. The axis has also a chain pulley, over which pass two endless chains, which give a rotary movement to the electrodes. Another pinion is aetuated by the one fixed on the axis, and gears into another (upper) wheel, on the face of which there are two or more cams, which by their movement admit of the gradual approach of the electrodes. For this purpose, two adjustable stops are fixed to the arms on which the electrodes are mounted, and the ends of these stops are brought into close contact with the peripheries of the cams, and adjusted so that the electrodes shall be at a proper distance apart. The arms are drawn together by a spiral spring, and the distance to which they are separated will therefore be regulated by the upper wheel and its cams.

The wires being attached to the battery, and motion imparted to the dises, and to the upper wheel, the circuit is first elosed by bringing the discs together, and then the discs are separated to the proper distance for the produetion of light, and the stops adjusted to that distance. By the revolving motion of the dises new surfaces are eonstantly presented to each other, and the old and worn surfaces in passing through the stirrup in the arms to whieh they are fixed arc cleared from any adhering dust before coming round to be again submitted to the actiou of the electric eurrent. The upper wheel, whieh has a slower motion than the discs, with eaeh revolution, admits the stops on to a smaller part of the cams, by whieh means the arms arc drawn nearer together, so as to compensate for the reduced diameters of the discs as they become worn.

Both Mr. Staite and Mr. Lemolt have patented certain modifications in the batteries which they reeommended to be used for obtaining the electric light, but there is nothing deserving of particular notiee in referenee to these so-called improvements. Mr. Staite calls his patented battery "the perfluent battery," the exciting fluid being made to run from one eell to another throughout the whole series, and thus to become fully saturated with the metal before it passes out of the battery. There are obvious disadvantages in this arrangement, and, indeed, it would appear as if the object of the patentee had been to invent something new, rather than to improve on what was previously known in reference to galvanic batteries. Mr. Lemolt's patented battery is a modifieation, with very slight variation, of Bunsen's battery.

I am informed that the patented batteries have not been used by the patentees in the public exhibitions which have been made of the light.

Having now described the means which have been proposed and patented for keeping the chareoal points of an electrie-light apparatus adjusted, and otherwise giving permanence to the light obtained by electricity, I purpose, in the next place, explaining the conditions which tend to modify the effects in these applications of the electric foree.

We have hitherto only considered the effects produeed under one set of cireumstances. We have used a battery of sixty cells, united in one serics, and with this the light has been developed in two ways,—by rendering a platinum wire incandescent, and by igniting the ends of two charcoal electrodes, and then separating the points, by which latter means the greatest amount of light is obtained. In these experiments thc platinum wire and eharcoal points have been exposed to the free contaet of atmospheric air. Under these conditions we have produced a comparatively feeble calorific effect upon the platinum, but an arc of light of considerable length and great intensity has been obtained with the charcoal.

We have now to observe how the effects may be modified by different arrangements of the battery, by the condition of the ignited bodies, and by the media by which they are surrounded.

In showing the effeets of different arrangements of the battery, I will employ but one kind of battery, namely Grove's, of whieh sixty cells will be used.

This battery is now arranged with the cells in one series, so that the current of eleetrieity, which starts from the zine end of the battery, passes through all the eells, and thus acquires greatest intensity. But thc quantity of eleetricity in the eurrent is that only which any separate cell could produce.

We here have a eomparatively small quantity of electricity in a high state of tension. The power of the battery is now adapted for overeoming resistanees. The current would pass through a eonsiderable length of an imperfect conduetor, and this is the kind, and the only kind, of advantage gained by increasing the extent of the battery in this way. The space between the separated charcoal points is an imperfect conducting medium; and, while the battery is arranged, as at present, in one series, this space may be extended to the length of half an ineh or more without breaking the eireuit. So also, if we pass this current of eleetricity through a wire whieh is a bad conductor, sueh as platinum, it will be found that the sixty eells thus arranged will not heat a thieker wire to redness than would a battery of twenty, or even ten, of the same eells. The platinum wire beeomes heated and incandescent beeause it offers resistance to the current, and the resistance increases with the inereased length of the wire, so that by lengthening the wire we may at last stop the eurrent, the resistance beeoming greater than the tension or intensity of the foree is capable of overcoming. The length of wire, then, whieh we are thus able to heat to redness will depend on the tension of the current, or, what is equivalent, on the number of cells in series in the battery, just as does the length of the arc of light between charcoal points; and the diameter of the wire thus heated will depend on the quantity of electricity, or the number of polar chains in the current, which is influenced by other eonditions, and is almost wholly independent of the number of cells in series.

Having thus observed the effects produced by sixty cells in one series, we will now alter the arrangement.

Of the sixty cells whieh have been used twenty are of larger size than the others. If we use these twenty cells in a series, disconnecting the other forty, it will be seen that the arc of light produced between the chareoal points is shorter, as also is the length of wire that we can heat to redness; yet we get a flame of greater diameter with the charcoal, and can heat a thicker wire.

It is important to be aware of this result, for we thus find that when there are cells of different sizes or degrees of activity in a series the quantity of electricity will be that produced by the smallest or least active eell among them. The larger size, or better condition, of any part of the series, as compared with other parts, is of no avail—thc least powerful eell governs all the others, and reduces them to its own standard.

We have thus obtained a greater quantity of eleetricity from twenty eells than from a series of sixty, of which this twenty formed part, the latter being of a larger size than the others.

We may now introduce another set of twenty cells into the battery, but in doing this they shall be united in a different arrangement from that first adopted. Instead of having them all in one series, we will now have them in two series. By this means we do not increase the tension or intensity of the current, but we get a greater quantity of electricity. If the second twenty cells be the same as the first, the quantity will be doubled, but the intensity will still be that of twenty couples.

We can now heat to redness a wire of much greater diameter than we could before, and we get a thieker are of light with the chareoal.

By adding still another set of twenty eells in a third series, we shall have the sixty cells in operation, producing three times the quantity of electricity that we originally obtained from the same battery arranged in one series. The battery is now adapted for produeing powerful calorific effects. Platinum wire of eonsiderable size may now be ignited to a white heat, the more fusible metals deflagrated with great brilliancy, and the magnetic effects whieh the eurrent is capable of indueing in surrounding bodies will be found to be very powerful.

[The different arrangements of the battery were illustrated by drawings.]

Such are the modifications in the effeets resulting from different arrangements of the battery. There are other modifieations, which are eaused either by varying the nature or condition of the eonduеting medium in whieh the heat and light are developed, or by alterations in surrounding eireumstanees whieh exercise an influence on the development of the heat and light.

Thus, for instance, in getting the light from charcoal points, the effeet will depend, in some measure, upon the quality of ehareoal. If the ehareoal be soft and porous, the points will be very rapidly destroyed when a powerful eurrent of eleetrieity is transmitted. Hard and eompact eharcoal is required if the effects are to be long-continued.

Box-wood charcoal possesses a tolerable degree of eompaetness, but is deficient in hardness. It yields an exceedingly bright and pure light, but wears away rather quiekly.

Hard coke, espeeially that which is sometimes found eoating the inner surfaee of the gas-retorts, possesses qualities which render it peeuliarly well adapted for affording a steady and eontinuous light. The light obtained from coke points, however, is not so bright or so white as that afforded by good box-wood ehareoal.

Mr. Staite has used with advantage hard coke chareoal whieh has been dipped into melted sugar and then calcined in closed tubes, by which means the interstices of the porous coke are filled up with the charcoal of the decomposed sugar, and the qualities of hardness and compaetness are thus well combined.

The impurities present in some varieties of ehareoal affeet the quality, and sometimes also the quantity, of light emitted. Coke freqently eontains a good deal of silieeous matter, which appears to diminish the light. Certain saline bodies alter the eharacter of the light, and this is sometimes accompanied by an increase in the quantity of light.

[The effeet of some saline bodies in increasing the amount of light was shown in a very marked manner by using charcoal points which had been soaked in solution of chloride of sodium, and subsequently dried. A very large and intensely luminous flame was thus obtained, greatly surpassing the effects produced in any other way.]

Now, in all the cases hitherto adduced, the differences in the light produced, where the electric foree has been uniform, have been eaused by alterations in the nature or condition of the conducting medium. Similar modifications, however, are sometimes caused by alterations in the atmosphere by whieh the condueting medium is surrounded.

In effecting the ignition of a platinum wire, or of charcoal, the intensity of the light is very much augmented, and the results in other respects rendered more satisfactory, by rarefying or completely removing the surrounding air. As the air is removed from the receiver in which the platinum is heated the ignition beeomes mueh more intense, and the light consequently much stronger.

Similar results are also obtained with eharcoal, and in this ease we derive a twofold advantage from the removal of the air. Not only is the light increased, but the combustion of the charcoal is entirely prevented.

We thus see that the effect—the production of the light—does not necessarily involve any chemical action at the point at which the light is developed. The chemical action is in the battery. There is not necessarily any chemical action where the light is produced; yet, if the charcoal be surrounded by air, there will be combustion to a certain extent, and carbonic acid produced; but by enclosing the charcoal in a vacuum, or in a vessel filled with carbonic acid, that result is obviated.

The influence which the surrounding atmosphere exercises in modifying the calorific effects of a current of electricity is very remarkable, and, in some respects, at present inexplicable.

Having observed that the rarefaction of the air surrounding the ignited platinum wire renders the ignition more vivid and the light stronger, it might have been inferred that the effects would be similarly increased by substituting the lighter gases, such as hydrogen, for atmospheric air. Experiment teaches us, however, that this is not the case. On the contrary, a wire which is rendered incandescent by a current of electricity when surrounded by atmospheric air will transmit the same current without any such effect being produced when it is surrounded by hydrogen gas.

It is obvious, therefore, that it is not merely the tenuity or rarefaction of the atmosphere upon which the result depends, but that different gases, when surrounding the conducting medium, produce specific effects in modifying the development of heat and light.

I have now described the most important conditions by which the effects of the galvanic battery are modified, in its application for the production of light; and we may proceed to apply some of the principles which I have endeavoured to explain and establish, in testing the probability of a realization of the prospects held out by certain speculative adventurers, who have represented the voltaic battery as an economical and advantageous source of light, which is speedily to supersede gas, oil, and candles.

The defects in the ordinary means of obtaining light, and the evils attendant upon the application of such means, are universally admitted. No one denies that the light thus obtained is imperfect, and that its production is accompanied by the conversion of valuable substances into worthless and deleterious products, by which the atmospheres of our houses are rendered less wholesome than they would otherwise be.

No one denies that the electric light is most brilliant and pure, and that its production does not necessarily involve any deterioration of the quality of the surrounding atmosphere, or the conversion of valuable substances into worthless products.

With reference to these broad and general statements there is no difference of opinion. The projectors of the electric light, therefore, appear to have a good foundation on which to establish their claim for the superior advantages of the means they propose for producing light.

On a superficial view of the subject, there is some show of reason in their statements, that we are wastefully destroying coals, and oil, and wax or tallow, in the production of bad light, and of noxious gases, by combustion; while, in the manufacture of valuable chemical compounds, abundance of pure light might be obtained as a secondary product, the collection and application of which have hitherto been neglected.

It has been suggested that the production of light should be associated with the manufacture of metallic compounds, such as sulphate and oxide of zinc, sulphate of copper, nitrate and carbonate of lead, &c. In every case, when these compounds are made by dissolving the metals in the respective acids, electricity is developed, but in most cases it is not collected or applied. The galvanic battery is an apparatus by means of which such application might be made.

Is there, then, anything unreasonable in the proposition that manufactories of metallic compounds should be established like gasworks, and that the electricity thus obtained should be carried into our streets and houses through wires, as gas now is through pipes, to be applied as a source of light? There is something imposing in the boldness of such a proposition, and one naturally clings to it in the hope that it might be practicable. In the present state of our knowledge, however, such a scheme must be considered as perfectly chimerical, and unsupported by any experimental results. It may be thought that the power which appears so manageable at the lecture-table—which we lay on or turn off with such facility, and which we can develop in any part of the circuit—might be conducted to any or every part of a town, and used as required. There would indeed be no difficulty in conveying the power wherever we wished for it, but there would be serious and insuperable obstacles to its development in the form of light at many points in the circuit at the same time. We obtain light as the result of a transformation of the power in its effort to overcome resistance. It requires a considerable accumulation of force to give an arc of light with charcoal points of half an inch in length; and having thus applied this amount of force, transforming it into heat and light, it is no longer similarly available to us in any other part of the circuit.

Wherever electricity is to be used as a source of light, I can see no other method of applying it than by having a separate battery for every light. This would undoubtedly be the case with the charcoal light, in consequence of the difficulty of otherwise maintaining an unbroken circuit. Now, this fact is sufficient to dispose of the question as to the probability of the electric light being substituted for lamps and candles in our streets and houses. I believe, however, it has been suggested that every house should be provided with a galvanic battery as a source of light, and that carts should be sent round from day to day to collect the sulphate of zinc or other metallic salt formed in the process; but those experienced in the use of voltaic apparatus will know how to estimate the probability of such a plan being put into effect.

It is not for general use that there is any present prospect of applying the electric light, but in some special cases where light of great intensity is required, as, for instance, in signal lights, on railroads, and in lighthouses. There are probably no difficulties in the application of the electric light in such cases that may not be overcome; but I think it would be saying too much to admit that this object has been accomplished by any of the contrivances hitherto suggested.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LIV.

(LECTURE LXXXII.)

SAPONIN—(*Continued*).

VIRGINIAN POLYGALA.

The root of the Virginian polygala (Polygala senega) has been analyzed successively by MM. Gehlen, Feneulle, Dulong, Folchi, and Quevenne.

According to Quevenne's analysis, the root of polygala contains:—

Polygalic acid,
Virgineïc acid,
Pectic acid,
Tannic acid,
A yellow colouring matter of bitter taste,
Gum,
Albumen,
Cerin,
Fixed oil,
Several salts.

The polygalic acid (Gehlen's senegin) is the most important and most active part of the root. It exists in the latter in the free state. It is a white pulverulent, inodorous substance, of a faint taste at first, but which speedily becomes pungent and acrid. It produces a painful feeling of constriction in the throat. It provokes sneezing. It contains no nitrogen. It is non-volatile. It dissolves slowly in cold, very readily in boiling, water. The solution of polygalic acid reddens litmus paper, has an acrid, pungent taste, and is very frothy; it keeps for a length of time without suffering alteration.

Polygalic acid is also very readily soluble in alcohol; from hot alcoholic solutions part of the acid separates upon cooling. It is altogether insoluble in sulphuric ether, in acetic ether, and in the fixed and volatile oils. Its acid properties are very feeble: it fails to expel carbonic acid and hydrosulphuric acid from their combinations. The polygalates of potass, soda, and ammonia alone are soluble. The subacetate of lead and the protonitrate of mercury are the only salts which precipitate polygalic acid from its solutions. M. Buvenne, on comparing the properties of polygalic with those of saponin, found that these two substances differ only very slightly. Polygalic acid is, however, less soluble in water than saponin, and yields with hydrochloric acid a bitter gelatinous acid which forms bitter salts, whereas saponin, when treated with hydrochloric acid, yields a crystalline acid, free from all bitter taste, and which forms insipid salts.

Polygalic acid kills small-sized animals, at the dose of 30 to 40 centigrammes; given in smaller doses, it provokes vomiting, and an abundant secretion of mucous. The great efficacy of the root of polygala in cases of quinsey and chronic catarrh, particularly in aged persons, is attributable to the peculiar stimulating action which the polygalic acid exercises upon the mucous membranes.

The process of extracting the polygalic acid from the polygala-root is as follows:—Treat the root with alcohol of 80 Cent., until the whole of the matters soluble in that menstruum are dissolved out. Distil the alcohol off, and agitate the syrupy residue with ether, which will remove the fatty matters from it. Let the mixture stand at rest. After some time the pure polygalic acid will subside. Collect this on a filter, mix it with cold water, and add a little alcohol to the mixture, to facilitate the subsidence of the acid. Collect the latter again on the filter, and purify it by repeated solution in alcohol of 83 Cent., and by means of animal charcoal purified with hydrochloric acid. Filter the last alcoholic solution boiling; the polygalic acid will precipitate from the filtrate upon cooling. The mother liquors yield a fresh quantity of polygalic acid, which requires decoloration by means of animal charcoal.

The colouring matter of the polygala-root is bitter, which is its most remarkable characteristic. It has a yellowish-brown colour, and is inodorous. It fuses at 320° F. It is only very sparingly soluble in water, but dissolves readily in alcohol, in ether, and in alkaline solutions.

The polygala-root contains a tolerably large quantity of a fixed oil, of a reddish-brown colour and syrupy consistence.

This oil has a disagreeable rancid smell and taste; it is readily saponifiable. It contains, ready formed, a small quantity of a fatty volatile acid, to which Quevenne has given the name of virgineïc acid. This acid has an exceedingly penetrating odour, and the peculiar smell of the root is attributable, most probably to its presence. An additional and larger quantity of the acid is formed upon the saponification of the fixed oil of polygala.

Section I.—THE ENTIRE ROOT.

POWDER OF POLYGALA.

Reduce the root to powder, without leaving any residue.

The root of polygala is seldom administered in the form of powder.

SECTION II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON POLYGALA-ROOT.

Water extracts all the useful parts of the root. If the process of lixiviation be had recourse to, it will be well to bear in mind that the root is viscous, and swells up considerably, and that it will accordingly be necessary to pile the coarsely-pounded root as lightly as possible. The best way is that suggested by M. Mouchon, viz., to reduce the root to a semi-fine powder, to make this into a semi-liquid paste with water, and to pour this paste into the lixiviation apparatus.

On comparing the product obtained respectively by the maceration, infusion, and decoction of the polygala-root, I have found that the process of decoction gives a less sapid liquor than that obtained by either maceration or infusion. According to M. Quevenne, the reason of this is, that under the influence of protracted heat an insoluble compound is formed in the root, consisting of polygalic acid, colouring matter, and coagulated albumen. A similar compound, *minus* perhaps the albumen, and *plus* a little oil, is formed, and separates during the evaporation of the aqueous liquors of polygala (Dulong d'Assafort). This insoluble compound constitutes for the most part the apothema which separates during the preparation of extract of polygala.

INFUSION OF POLYGALA.

Take of Pounded polygala-root, 4 to 8 grammes.
Boiling water, 1,000 grammes.

Infuse for two hours, and strain.

The infusion of polygala is, as I have already stated, much more sapid than the decoction, and is unquestionably preferable to the latter. The root of polygala is so considerably charged with acrid matters that a ptisan made with 30 grammes of the root per quart of water is positively impotable on account of its excessive acridity.

PECTORAL POTION.

Take of The preceding infusion, 125 grammes.
Sugar syrup, 64 grammes.

Mix.

SYRUP OF POLYGALA.

Take of Pounded polygala-root, 1 part.
Boiling water, 5 parts.
White sugar, a sufficiency.

Let the root infuse in the water for two hours; strain and filter. Add to every 100 parts of the filtrate 190 parts of the sugar, and make a syrup by simple solution.

30 grammes of this syrup contain the soluble parts of 2 grammes of the root.

M. Mouchon proposes to extract the soluble parts of the root by lixiviation, and to prepare the syrup with the liquors obtained by that process. I prefer, however, to prepare the syrup with the infusion.

SECTION III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON POLYGALA-ROOT.

EXTRACT OF POLYGALA.

The Codex prescribes to prepare the extract of polygala with alcohol of 56 Cent. (21° Cartier).

I treated 100 parts of the root (picked and cleaned) with alcohol of 56 Cent. I obtained 59 parts of an extract of pilular consistence. From 100 parts of the root of commerce I obtained 43 parts of extract.

The aqueous extract of polygala is by no means a bad product; yet the alcoholic extract is preferable to it: in the first place, because, on account of the viscosity of the root, it is more easy to obtain concentrated liquors by means of alcohol than by means of water; and, in the second place, because, having a less amount of liquor to evaporate in the case of the alcoholic product, this diminishes the chances of the formation of the insoluble compound of polygalic acid, colouring matter, and oil, which is invariably produced during the evaporation, to the detriment of the properties of the extract.

TINCTURE OF POLYGALA.

Take of Polygala-root, 1 part.
Alcohol of 56 Cent. (21° Cartier), 5 parts.

F.S.A.

Perhaps it would be better to use six parts of alcohol instead of five, as the latter quantity does not suffice to dissolve the whole of the soluble parts of the root.

SARSAPARELLA—(*Sarzaparilla*).

Sarsaparella is the root of Smilax salsaparilla, and, no doubt, also of some allied species. It has been studied successively by MM. Canobia, Pallota, and Folchi, in Italy, and by MM. Thubœuf and Poggiale, in France.

It contains:—

A volatile oil,
Salsaparin,
A bitter acrid resin,
An oily matter,
Extractive matter,
Starch,
Albumen.

The volatile oil exists only in small quantity in the root. The salsaparin was first obtained from the root by Pallota, who called it *pariglin*. Folchi obtained subsequently the same substance, which he, however, believed to be a different body from that discovered by Palotta; he called it *smilacin*. Batka believed the new substance to be an acid, and called it accordingly *parillinic acid*. Since then M. Thubœuf, and after him Poggiale, have demonstrated the perfect identity of the three substances, which differ, in fact, simply in the respective methods of their production. MM. Thubœuf and Poggiale have finally given to this substance the name of *salsaparin*.

Salsaparin is a solid, colourless, and inodorous substance. It is crystallizable; its crystals cluster in radiated groups. It is a neutral body, combining neither with acids nor alkalis. Salsaparin bears considerable resemblance to saponin, from which it differs, however, in the following essential points:—It is a non-acid body; it crystallizes; it has hardly any taste when placed on the tongue, and acquires an acrid and slightly bitter taste only in solution; it is very sparingly soluble in cold water; it yields neither yellow resin nor mucic acid when treated with nitric acid, and is not converted into esculic acid by the action of hydrochloric acid.

Salsaparin is soluble to a very trifling extent in cold, but dissolves somewhat more readily in hot and boiling, water; its solution possesses to a high degree the property to froth up and form a lather when agitated. It is to its presence that infusions of sarsaparella owe this same property.

Alcohol, particularly when hot, dissolves salsaparin readily; from solutions in boiling alcohol it crystallizes upon cooling.

It is insoluble in ether. Iodine imparts to its aqueous solution a saffron tint. It is non-volatile, yet, according to M. Beral's observation, it volatilizes in the vapour of water.

The following is Thubœuf's process of extracting salsaparin from the sarsaparella-root:—Form an alcoholic tincture of sarsaparella with alcohol of 85 Cent.; distil off seven eighths of this tincture; add animal charcoal to the remaining eighth, boil, and filter. At the end of from twenty-four to forty-eight hours the filtrate will deposit a tolerably large quantity of salsaparin. In some instances even the whole liquid is found to solidify. Drain and purify the salsaparin by repeated solution in alcohol, and by means of animal charcoal. Evaporate the mother liquors in the water-bath, and redissolve the residue in water, which will leave a certain quantity of fatty and resinous matter undissolved. Evaporate the aqueous solution to dryness, and purify the product by repeated recrystallization from alcohol.

This process offers this disadvantage, that a portion of the salsaparin remains in the mother liquors. I find the following process both more commodious and more advantageous:—I prepare an alcoholic tincture of salsaparella, and drop into it a solution of acetate of lead until the last quantities added fail to produce a precipitate. If there happens to be an excess of lead in the mixture, I remove this by the addition of a few drops of sulphuric acid. I filter and distil. The liquors are here in a great measure decolorated already by the precipitation; they are less viscous, and deposit the salsaparin with greater facility. Yet even here a loss is sustained of a portion of the substance which remains in the last mother liquors; part of this, but not the whole, may be obtained by saturating the last liquors with chloride of sodium.

Sarsaparella enjoys, as is well known, considerable reputation as a remedial agent in venereal diseases. Whether this reputation is well-deserved or not remains as yet a matter of some doubt, several authorities denying it that efficacy which is so freely conceded to it by the great majority of physicians. Dr. Hancock, who used sarsaparella in his native land, attributes to it the special property to restore and strengthen the constitution of the patient. He tells us that, when given in large doses, it provokes nausea, slackens the movements of the heart, and throws the patient into a state of transient weakness. He reports the case of a negro who, having taken a strong dose of sarsaparella, complained of a feeling of absolute prostration, with a painful sensation in the limbs, as if every bone in his body were crushed. It is worthy of remark here that Pallota attributes the very same action and effects to salsaparin.

Where it is intended to act upon the root with water or alcohol it is usual to slit the root. With a view to this operation the root is generally kept for twenty-four hours in a cellar: here it swells a little, and may then be readily cut into longitudinal slices with a knife; these slices are then cut into small pieces, which are dried, and may be kept in this state.

It is advisable also to pound the pieces with a wooden pestle when required for use, for the ligneous body, which is compact and difficultly penetrable by water, contains salsaparin, though in smaller proportion than the cortical part. The best means, however, of properly comminuting sarsaparella is the grindstone, or even the nut-mill, which reduces the root to a mass resembling hemp, and which water and alcohol penetrate readily throughout.

SECTION I.—PREPARATIONS WHICH CONTAIN THE ENTIRE SUBSTANCE OF THE ROOT.

POWDER OF SARSAPARELLA.

Slice and cut the root in the manner indicated, dry the pieces in the stove, and pound them finally by contusion in an iron mortar, without leaving a residue.

Sarsaparella is never given in the form of powder; the reduction to this form has for its object simply to facilitate the dissolving action of the vehicle upon the root; and it is for this reason that every particle of the root is reduced to powder.

SECTION II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON THE ROOT.

HYDROLATE OF SARSAPARELLA.

In the treatment of sarsaparella by water the state of division of the root, and the temperature of the vehicle, are to be taken into account.

Water at 104° Fahrenheit will almost completely dissolve out the whole of the soluble principle of the ground or pounded root, provided it be used in sufficiently large quantity. (Let it be remarked here that the extraction of the whole of the soluble principle requires a rather considerable portion of water.)

The less perfectly comminuted root is only with difficulty penetrated by water; and even after repeated treatments with water at 104° Fahrenheit the root is still found to retain soluble

matters which have escaped the action of the vehicle.

The process of infusion should be resorted to only in cases where the root is imperfectly comminuted. To treat the powder of sarsaparella with boiling water would give a product containing a rather large proportion of starch. Even the infusion prepared with the imperfectly comminuted root contains invariably a certain amount of dissolved starch.

With respect to the process of decoction, this is, in my opinion, the least advantageous of all, particularly for sarsaparella in powder. The whole of the starch is dissolved by the protracted action of the boiling water, and a viscous product is obtained, which patients take with great repugnance only.

Notwithstanding, some practitioners regard the decoction of the sliced and contused root as a preparation superior to those obtained by maceration or by infusion. The only reason which they can possibly adduce for this strange preference is, that sarsaparella has from the beginning, and always, been used that way, and that this method ought to be considered good, since the root established its medical reputation at a time when no other process except decoction was resorted to. But the fact that the decoction of sarsaparella has useful properties does not by any means prove that the products obtained by maceration or infusion may not be greatly superior in every respect to the decoction, notwithstanding.

The infusion of sarsaparella, which is odorous and sapid, loses both smell and taste when boiled, even though only for a short time. This circumstance certainly does not speak greatly in favour of the process of decoction. We know, moreover, that the fibrous parts of vegetables yield always less soluble matters to the water when treated by decoction than by maceration or infusion; and, considering that water at 104° F. extracts the whole of the soluble principles of the root, it is difficult to see what possible advantage the process of decoction can be considered to have over the methods of infusion or maceration, except it be this, that with some patients the infusion will not agree, and perhaps, also, the greater mildness of the decoction, which is owing to the circumstance that this preparation contains a less amount of acrid matter than the infusion prepared with water at 104° F., and that the acridity is masked, moreover, to a certain extent by the starch which the liquor holds in solution.

With respect to the cause to which the deperdition of part of the salsaparin is attributable, I think this is ascribable to two circumstances, viz. :—1. The formation of an insoluble triple compound, analogous to that which the root of polygala yields under the same circumstances; and 2. The property of salsaparin to volatilize under the influence of aqueous vapours.

I have already stated that the complete extraction of the soluble parts of the root requires the use of considerable quantities of water.

For the preparation of a concentrated solution recourse must be had to hot water, which dissolves salsaparin much better than cold water. In cases where I require a *concentrated* solution I always follow M. Guibourt's method of treating the root by digestion in the water-bath.

Births and Deaths Registered in London during the Week ending Saturday last.—The number of deaths from all causes in the metropolis during the week ending Saturday last, according to the return of the Registrar-General, amounted to 1,058, being 95 above the weekly average of spring; there is, however, a small decrease on the two previous weeks. The excess of average arises from bronchitis and hooping-cough. The excess from bronchitis may be attributed to lowness of temperature. The mean of the week was 45° 9. Only one fatal case of cholera was registered in the week; it occurred in Whitechapel, and was that of a girl aged ten years. The number of births during the week was 1,528.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ISOMERIC MODIFICATIONS OF PHOSPHORIC ACID.

By H. ROSE,

*Professor of Chemistry in the University of Berlin.**

It has frequently been remarked that no substance presents greater difficulties in every respect to the chemist in its examination than phosphoric acid; whilst the longer and more constantly we are engaged in studying the reactions of this acid the greater do the difficulties become. Every time the investigation is renewed the chemist meets with new anomalies, and numerous new obscure phenomena are exhibited, whilst even those previously known are far from being satisfactorily explained.

Some time since, in an investigation upon the isomeric modifications of the peroxide of tin, I drew attention to the fact, that such modifications are principally met with in those metallic oxides which possess acid properties; they are almost entirely absent in those which possess strong basic properties. The latter certainly frequently alter in density to a considerable extent when exposed to various elevated temperatures, becoming at the same time soluble with difficulty or insoluble in acids; when, however, they are once dissolved, they always exhibit in solution the same reactions.

Phosphoric acid exhibits paradoxical isomeric properties still more than any metallic acid. After the important discovery of Clark, the ingenious investigations of Graham did much towards the elucidation of the difficulties; but by new investigations new facts have been discovered, part of which cannot be satisfactorily explained by Graham's views.

Assuming, in accordance with Graham's views, the existence of three modifications of phosphoric acid, viz., metaphosphoric, pyrophosphoric, and ordinary phosphoric acid, which with Berzelius we may denominate *a*-, *b*-, and *c*-phosphoric acid, it is the metaphosphoric acid which especially exhibits the greatest anomalies. The pyrophosphoric acid also presents some; and the ordinary phosphoric acid, the *c*-phosphoric acid, is that which has the most analogy with other oxy-acids in its behaviour towards reagents. This is the one which can be best separated and determined quantitatively. Fortunately the other modifications can be more or less easily converted into the *c*-phosphoric acid; hence in their quantitative determination this conversion must in most cases be previously effected.

I shall now make some remarks upon each of these three modifications of phosphoric acid.

a-Phosphoric Acid (Metaphosphoric Acid).

For the purpose of elucidating to a certain extent, if only for the present, the chaos of anomalous phenomena which this acid exhibits, we are compelled to admit the existence of several sub-modifications of it; at least three of these are now distinguishable.

1. One of these sub-modifications consists of the acid existing in Graham's metaphosphate of soda, which is obtained by fusing the acid phosphate of soda with the phosphate of soda and ammonia (microcosmic salt). After fusion the mass must be cooled rapidly, and not slowly. The solution of this salt, as is well known, possesses a neutral or very slightly acid reaction, and is especially characterized by giving precipitates with neutral solutions of several salts of the earths and metallic oxides, which are generally soluble in an excess of the salt of soda, and possess the remarkable property of forming a heavy, thick, oleaginous mass when shaken. The solution of the salt alone does not yield any precipitate with a dilute filtered solution of albumen, but a copious dense precipitate immediately appears on the addition of acetic acid.

The following are the special reactions of a solution of the metaphosphate of soda:—

Chloride of barium produces a voluminous precipitate, the supernatant liquid reddening litmus paper; it is entirely soluble in excess of the salt of soda; ammonia does not produce a precipitate in this solution. The precipitate is not oleaginous, nor does it become so, either when set aside for some time, or on ebullition.

Chloride of calcium produces a voluminous precipitate, which, on agitation, even in the cold, collects at the bottom of the vessel in the form of a thick, oily, or turpentine-like mass. The supernatant fluid reddens litmus paper. The mass is not affected by ebullition, but when heated with muriatic acid it is dissolved. The precipitate is entirely dissolved by excess of the soda salt; ammonia does not produce a precipitate in the solution.

A solution of sulphate of magnesia does not produce any precipitate, even on ebullition. If much of the soda salt has been added, no precipitate is produced in the solution by ammonia; in the opposite case, ammonia produces a precipitate which is soluble in chloride of ammonium.

Nitrate of silver produces a dense, voluminous, white precipitate, which is soluble in ammonia and nitric acid. It is also perfectly soluble in a large excess of the salt of soda. The supernatant liquid reddens litmus paper. The precipitate does not become oleaginous when shaken in the cold, but when boiled it contracts, occupying a smaller volume, and becomes perfectly resinous. Heat renders it tenacious, so that it can be drawn into threads; and on cooling it solidifies to a brittle mass.

A solution of pernitrate of mercury, which necessarily contains free acid, produces a white precipitate; this when shaken, even in the cold, subsides to the bottom of the vessel as a dense oleaginous mass.

Solution of bichloride of mercury produces no change.

Solution of protonitrate of mercury produces a dense white precipitate, which is soluble in an excess of the soda salt; on boiling it becomes resinous, like the salt of silver.

Solution of sulphate of copper produces no change; but chloride of copper produces a bluish-white precipitate, which is soluble both in excess of the soda salt and of the chloride of copper.

Solution of acetate of lead produces a dense voluminous precipitate, which is soluble in excess of the soda salt, and when shaken forms a coherent mass, but does not become oleaginous; when set aside, however, it becomes somewhat resinous.

Solution of protosulphate of manganese produces a white precipitate, which when shaken becomes an oily mass. The precipitate is soluble in an excess of the soda salt; sulphuret of ammonium throws down sulphuret of manganese from this solution.

Solution of protosulphate of iron does not produce a precipitate; nor is any precipitation caused by the addition of ammonia to this solution, but it renders it dark green.

Solution of sulphate of zinc produces no change.

Solutions of the sulphates of cobalt and nickel also produce no change. However, solutions of the chlorides of cobalt and nickel produce red and greenish-white precipitates, which on agitation subside in the form of heavy oily drops of a red and greenish-white colour. The precipitates are soluble in excess of the soda salt.

Solution of the nitrate of bismuth, although it contains free acid, produces a white precipitate, which on agitation becomes somewhat resinous, but not oily. The precipitate is soluble in the soda salt.

If the acid contained in the salt of soda be separated from the base, its aqueous solution exhibits somewhat different properties from those of the aqueous solution of the metaphosphoric acid produced by combustion in oxygen gas.

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* Poggendorff's "Annalen der Physic und Chemie," vol. lxxvi., p. 1, and "Philosophical Magazine."

The solution of the soda salt was precipitated with nitrate of silver, and the precipitate allowed to remain in the liquid during one night; it was then washed with cold water, and, after suspension in water, was decomposed by a current of sulphuretted hydrogen. The sulphuret of silver formed remains suspended in the free acid for a long time, and is separated by filtration with extreme difficulty.

The aqueous solution of the acid does not at first produce any precipitate in chloride of barium; after a considerable time merely some flakes subside. Barytic-water, however, produces a precipitate in it, even when not added in excess, and whilst the solution is still acid.

Chloride of calcium produces no precipitate. Lime-water only produces a precipitate when added in excess.

A solution of sulphate of magnesia mixed with chloride of ammonium only produces a precipitate in the solution of the acid saturated with ammonia, when the solutions are concentrated. This is, however, soluble in a considerable quantity of water, and hence does not appear in dilute solutions.

Solution of nitrate of silver produces a white precipitate, which, on the saturation of the solution with ammonia, becomes more considerable.

In a solution of albumen a copious white precipitate is immediately formed.

The reactions of a solution of metaphosphoric acid produced by the combustion of phosphorus in oxygen gas differ somewhat from those of the acid as procured from the salt of soda.

Thus a solution of chloride of barium immediately produces a copious precipitate in it. A very large excess of the acid is requisite to redissolve the precipitate; ammonia does not produce any precipitate in this solution. Barytic-water produces a precipitate in the acid, even when the latter is in great excess; an excess of barytic-water, however, renders it more copious.

Solution of chloride of calcium produces an extremely small precipitate, which is perfectly soluble in excess of the acid. Ammonia produces a dense voluminous precipitate in this solution. Lime-water does not cause any precipitate until added in excess. Both acids exhibit the same reactions with sulphate of magnesia, nitrate of silver, and albumen.

These two acids, therefore, differ principally in their reaction with chloride of barium. But as solutions of Graham's metaphosphate of soda, as stated above, when decomposed by solutions of neutral salts, yield liquids which possess an acid reaction, the acid separated from the precipitates must be different from that in the soda salt used.

As the composition of the oily and resinous precipitates produced by Graham's salt was entirely unknown, the salt of silver was analyzed by M. Weber. It was prepared in the same manner as the salt precipitated for the purpose of obtaining the free acid. After having been dried for a long time at 212° F., 0.930 grm. lost at a red heat 0.019 grm., or 2.04 per cent., of water. It fused into a mass of a yellowish colour, which, when dissolved in nitric acid, yielded on the addition of hydrochloric acid 0.815 grm. of chloride of silver, corresponding to 70.09 oxide of silver. The phosphoric acid in the filtered liquid was precipitated in the form of the phosphate of ammonia and magnesia; 0.257 grm. of pyrophosphate of magnesia was obtained after heating to redness, corresponding to 27.87 per cent. of phosphoric acid.

These results correspond to the formula $3AgO, 2P_2O_5 + HO$. Berzelius examined this salt long ago, but he obtained it in a different manner. He precipitated a solution of phosphoric acid which had been recently heated to redness with nitrate of silver; he then obtained a precipitate, the composition of which but little resembled that of AgO, P_2O_5, the amount of oxide of silver differing nearly three per cent. from that calculated. This salt was placed in boiling water; in a few minutes it fused into a viscid mass resembling turpentine, and had the same composition as the compound mentioned above.

The composition found above explains the acid reaction of the liquid when the neutral solution of Graham's salt is precipitated with solution of nitrate of silver. It also renders evident why the acid separated from the silver salt may possess different properties from metaphosphoric acid as obtained by the combustion of phosphorus. The question whether the other oleaginous salts, which a solution of Graham's salt forms with other neutral salts, possess an analogous composition to the silver salt, as might be expected from the circumstance that on their formation the solutions which are originally neutral acquire an acid reaction, well deserves investigation.

A salt of silver having an analogous composition can be prepared from Graham's salt. M. Fleitmann decomposed Graham's salt with nitrate of silver, filtered the precipitate immediately, washed it slightly with cold water, and then pressed it strongly between blotting-paper. The water used in the washing possessed a barely acid reaction. The fused compound gave the following per-centage composition:—

Phosphoric acid	37.62
Oxide of silver	61.18
	98.80

which closely approximates the composition calculated according to the formula AgO, P_2O_5, which requires 61.89 oxide of silver and 38.11 phosphoric acid. The loss probably arises from its containing a little soda, which was not removed in consequence of the rapidity with which the compound was washed. It is thus evident that when the silver salt is precipitated and separated as quickly as possible from the liquid it corresponds in composition with Graham's salt; but that on prolonged contact with the liquid, even when cold, it becomes decomposed and loses acid.

Whether anything similar occurs in the case of the other precipitates has not been determined; but it is not improbable, as at first they are precipitated in a pulverulent form, and only acquire the oily appearance when powerfully shaken, by which they probably lose a portion of the phosphoric acid.

2. The acid existing in those remarkable salts, which Fleitmann and Henneberg obtained from the acid phosphate of soda, or rather from the microcosmic salt, by fusion and very gradual cooling, may be regarded as a second sub-modification of metaphosphoric acid. This salt has exactly the same composition as the metaphosphates; it contains the same number of atoms of base and acid, and has therefore the composition of Graham's salt, but differs from it in its opacity and crystalline structure, whilst Graham's salt is transparent and amorphous. It crystallizes from its solution with four atoms of water, whilst Graham's salt cannot be made to crystallize. Its solution, like that of Graham's salt, exerts a neutral reaction.

The most remarkable property of the acid of this salt is, that it forms with all bases compounds soluble in water, in which respect it differs essentially from all the modifications of phosphoric acid. The salts, even the silver salt, can be obtained in a crystalline state. According to Fleitmann, the solution of the soda salt produces no precipitates with solutions of nitrate of silver, nitrate of lead, chloride of barium, chloride of calcium, chloride of strontium, sulphate of magnesia, protosulphate of manganese, protosulphate of iron, the sulphates of zinc, cobalt, or nickel. In the solutions of the proto and per nitrates of mercury the solution of the soda salt at first produces no turbidity, but after a considerable time a precipitate is formed. It also produces a precipitate in a solution of acetate of lead.

The solution of the soda salt, as also that of Graham's salt, produces no precipitate with albumen; but this is the case when acetic acid is added. According to Fleitmann, the acid may be readily isolated from the solution of the crystallized silver salt by a current of sulphuretted hydrogen. The solution of the free acid immediately produces a copious precipitate with albumen. When saturated with carbonate of soda, the original soda salt is again obtained; and if its solution, after neutralization with ammonia, is treated with nitrate of silver, the crystallized silver salt can be procured from the solution.

3. The acid contained in those salts which were formerly called acid phosphates, and have long been known, may be regarded as forming the third modification of metaphosphoric acid. These salts have recently been examined by Maddrell. In obtaining them, Maddrell made use of salts of the most different kinds—metallic chlorides, sulphates, nitrates, carbonates, and chlorates, which were heated to + 600° F. with free phosphoric acid. I shall presently show that an insoluble pyrophosphate, possessing similar properties to those presented by Maddrell's metaphosphates, may be simultaneously formed. The heating with free phosphoric acid must therefore be continued until a portion of the heated mass, when removed, is found to precipitate a solution of albumen.

The insoluble metaphosphates dissolve when heated with concentrated sulphuric acid. According to Fleitmann, the acid cannot be isolated, or at least only very imperfectly, by transmitting a current of sulphuretted hydrogen through the copper salt suspended in water. The decomposition of it is best effected by treating the above salt with sulphuret of sodium. A soluble soda salt is then obtained, which somewhat resembles Fleitmann's metaphosphate of soda, but differs from it in many respects, and can only be procured with half its water of crystallization.

The various sub-modifications of metaphosphoric acid all agree in having the same capacity of saturation; one atom of acid saturates one atom of a powerful base. Graham supposes that the different capacity of saturation of the various modifications of phosphoric acid is the cause of their different reactions. This difference in the capacity of saturation of the various phosphoric acids, however, is indisputably a result of their isomeric state, and, as I have remarked on a former occasion, cannot be the cause of them.

A second general property of all the varieties of metaphosphoric acid is, that their aqueous solutions precipitate a solution of albumen. This is almost the only property by which the various kinds of metaphosphoric acid can be recognised in qualitative examinations, and unequivocally distinguished from the other modifications of phosphoric acid; for neither pyrophosphoric acid nor the ordinary *c*-acid precipitates albumen. The soluble salts of metaphosphoric acid do not precipitate albumen until acetic acid has been added to their solutions.

The property of metaphosphoric acid to produce a copious precipitate in the solution of chloride of barium is especially peculiar to the acid produced by the combustion of phosphorus only.

When a concentrated solution of *c*-phosphoric acid is heated very gently for several hours, so that none of it volatilizes, an acid is obtained, the aqueous solution of which does not produce any precipitate with albumen; nor does it produce a precipitate with chloride of barium, or merely an inconsiderable troubling after a long time. Nitrate of silver, however, produces a white precipitate. These are the properties of pyrophosphoric acid. When the same acid is heated in a platinum crucible longer and more strongly, so that it commences to be copiously volatilized, its aqueous solution then immediately produces a copious precipitate with albumen and chloride of barium, and a white precipitate with nitrate of silver, which when shaken becomes resinous. Thus by strongly heating it metaphosphoric acid is formed, and apparently the same modification as that obtained by the combustion of phosphorus.

By the rapid application of a certain degree of heat, however, an acid can be obtained, the

aqueous solution of which affords with albumen a copious precipitate, but none with chloride of barium, and which, after saturation with ammonia, yields a white precipitate with nitrate of silver, in which, after some time, an admixture of yellow can be distinctly perceived. In this case, the same acid as that which I separated from the metaphosphate of silver appeared to have been formed, in admixture with a little undecomposed *c*-phosphoric acid.

Some uncertainty still continues regarding the composition of fused phosphoric acid. A very long time since I made several experiments upon this point, and found that the acid, fused for a considerable time over a spirit-lamp, in three experiments, contained a slightly less amount of water than is required by the compound $P_2O_5 + HO$. In another experiment, probably with some acid which had been heated more strongly, and for a longer time, the amount of water was still less, and nearly corresponded to the compound $3P_2O_5 + 5(P_2O_5 + HO)$; hence it is thus rendered probable that phosphoric acid would be obtained in a perfectly anhydrous state by a very long and continuous application of heat.

My experiments have been recently confirmed by M. Weber, who examined an acid which had been exposed for a considerable time to a temperature at which it began to be slightly volatilized; 3.127 grms. of this acid, when treated with 16.891 grms. of oxide of lead, left, after having been heated to redness, a residue of 19.700 grms. The per-centage composition of the acid was, therefore:—

Phosphoric acid	89.84
Water	10.16
	100.00

In this case also the quantity of water is slightly less than the composition $P_2O_5 + HO$ requires. The quantities of oxygen are in the proportion of 50.34 : 9.03.

In addition to these three sub-modifications of metaphosphoric acid, there are undoubtedly others. That acid which is formed on burning phosphorus in dry atmospheric air or oxygen gas may be considered as a fourth sub-modification, for, as has been stated above, the reactions of its solution are different from those of the other modifications. The salts which it forms with bases have not been prepared and examined. I shall merely remark here that anhydrous phosphoric acid does not exhibit any affinity towards dry ammoniacal gas, nor does it absorb it; hence it differs in this respect from anhydrous sulphuric acid. Probably the various sub-modifications of metaphosphoric acid should be considered as conjugate acids, as the difference in their reactions would then be more satisfactorily explained. Anhydrous phosphoric acid may constitute the conjunct, which is capable of combining in different proportions with pyrophosphoric acid or with *c*-phosphoric acid, giving rise to the numerous modifications of metaphosphoric acid. This conjunct *per se* probably alone possesses the property of precipitating albumen, and thus this property is communicated to all the varieties of metaphosphoric acid.

[*To be concluded next week.*]

ON A NEW KIND OF COPAIVA BALSAM.

By Dr. L. POSSELT.

The various kinds of copaiva balsam hitherto met with in commerce furnish, when mixed with a solution of potash or ammonia, a more or less clear solution. After some time the ammoniacal solution deposits the ammonia salt of an acid resin, the copaivic acid. When this reaction does not take place, it has hitherto generally been assumed that the balsam has been adulterated. The author procured from England a balsam which had been derived from South America, the genuineness of which was guaranteed, and was likewise placed beyond all doubt by the results of analysis; he is, therefore, of opinion that there exists a distinct kind of copaiva balsam, which has the greatest resemblance to the ordinary kind, but differs considerably from it in its characters. It is more liquid and of a lighter yellow colour, has the peculiar disagreeable odour of the ordinary balsam, and also the lasting taste. Its specific gravity is 0.94. Mixed in any proportion with solution of potash or ammonia, it remains turbid, and never forms with a soapy mixture, but after a time again separates from those liquids. It does not dissolve perfectly in alcohol, but forms a milky liquid. It contains 82 per cent. of oil and 18 per cent. of resin, which latter is partly soluble and partly insoluble. The oil in the pure state is a

Hydrocarbon, $C_{10}H_8$, which the author calls paracopaiva oil. It is obtained by distilling this copaiva balsam with water. After a second distillation with water the hydrocarbon forms a colourless thick oil, of a strong pure odour of copaiva, and an acrid burning taste; spec. grav. 0.91; boiling point, 485°. This, however, quickly and uninterruptedly rises, the boiling oil being decomposed. It becomes yellowish, thickish, then brown, thick, and tenacious, until it is finally decomposed with separation of carbon. It mixes in every proportion with ether, requires a large quantity of absolute alcohol for solution, and dissolves with great difficulty in spirit of 0.863 spec. grav. Dry muriatic gas combines with it, forming a brown liquid with a reddish tint, which when saturated fumes in the air. No crystalline compound could be separated from it. This paracopaiva oil differs, therefore, from the ordinary oil by its thickness, its behaviour towards alcohol, muriatic acid gas, and its boiling point.

Nitric acid of 1.32 spec. grav. has no action upon the oil at the ordinary temperature; but on the application of heat it is converted, with a violent reaction, into a resinous substance. It dissolves entirely in dilute nitric acid in some days, when nitrous acid, carbonic acid, and some peculiar volatile acids which furnish a precipitate with basic acetate of lead, escape. The residue, evaporated and diluted with water, deposits an acid resin, which is not further acted upon by nitric acid, whilst a crystalline acid remains dissolved in the liquid.

The resin is of a light yellow colour, somewhat soluble in boiling water; it becomes milky on cooling. It dissolves readily in ether and alcohol, and after a considerable length of time some small crystals of the resin are deposited. It has an acid reaction, and combines with potash and ammonia, forming red neutral compounds soluble in water.

The acid left in solution crystallizes in minute, colourless, transparent laminæ. It is readily soluble in water, alcohol, ether, and naphtha. It is free from smell, has a bitter taste, and a faint acid reaction. It deflagrates with fuming nitric acid. Iodine dissolves in it; with chlorine it gives off vapours of muriatic acid gas, and then becomes yellow and tenacious. It acquires a dark violet-red colour when treated with concentrated sulphuric acid. The analysis of the paracopaiva oil gave:—

Carbon	88.13	10 = 60	88.23
Hydrogen	11.77	8 = 8	11.77

The resin, which with the paracopaiva oil constitutes the original balsam, was prepared by boiling the residue of the distillation of the oil with water to expel the remainder of the oil. The residual pale brown friable mass consists of two different resins, one of which is readily soluble and the other insoluble in alcohol. The soluble resin forms the greater portion of the mixture, and may be readily obtained pure by repeated solution in alcohol, when the second resin is left behind. It is light yellow, easily reduced to powder, soft at a gentle heat, and is decomposed at a slightly elevated temperature, becoming dark-coloured and forming a thick liquid. It dissolves in weak boiling spirit, but separates for the greater part on cooling in white flakes; it is likewise readily soluble in strong alcohol in the cold, in ether, and in naphtha. The alcoholic solution does not possess an acid reaction; no precipitate is produced with acetate of copper; it is insoluble in potash or ammonia. On analysis this resin was found to contain 60.06-59.98 per cent. carbon and 8.48-8.27 hydrogen.

The resin insoluble in alcohol is repeatedly exhausted with absolute alcohol, dissolved in ether, and separated by evaporation; it has the same colour as the preceding one, is insoluble in dilute alcohol, and very sparingly soluble in boiling absolute alcohol, from which solution it mostly separates on cooling; it dissolves readily in ether and naphtha; the solution is not acid. It is perfectly insoluble in potash and ammonia. On boiling these liquids with the resin they become opaque, and deposit on cooling the suspended resin. The solution of the resin furnishes with acetate of copper a slight precipitate. On analysis the resin furnished 81.76-82.12 carbon and 10.56-10.48 hydrogen.

It results from this investigation that this balsam is not ordinary copaiva balsam adulterated, but a distinct kind. The author had no opportunity of making any experiments as to its effectiveness.—Liebig's *Annalen*, lxix., p. 67.

ON THE CAUSE OF THE DIURNAL VARIATIONS OF THE MAGNETIC NEEDLE.

By W. H. BARLOW, Esq., M.I.C.E.

[To the Editors of the Philosophical Magazine and Journal.]

Gentlemen,—In the number of your journal for April an extract from a letter from M. de la Rive to M. Arago* is published, in which the author attributes the diurnal variations of the magnetic needle and the auroræ boreales to the effect of electric currents at the surface of the earth and in the atmosphere.

In confirmation of this theory, mention is made of a remarkable effect observed by M. Matteucci in the apparatus of the electric telegraph between Ravenna and Pisa during the magnificent aurora on the 17th of last November; and the author concludes by observing that "it would be highly interesting and important to profit by those telegraph wires which are found to have a direction more or less approaching to that of the declination needle, in order to make with them, when they are not in use for ordinary purposes, some observations which would enable us to demonstrate and to measure the electric currents which probably traverse them."

My object in addressing you is to state that in the early part of 1847 I was led to undertake extensive observations on this subject, in consequence of the peculiar disturbances occasionally visible on the telegraph instruments of the Midland Railway (on which line the telegraph was erected under my superintendence as the company's engineer).

These disturbances were at first attributed to atmospheric electricity passing to the earth by means of the wires; but from certain effects observed I was led to infer that they were due to other causes; and, in order to explain these effects, it is necessary to state that the Midland system of telegraphs consists of four principal lines centering in Derby, as follows:—

1st. From Derby northwards to Leeds.
2d. From Derby north-east to Lincoln.
3d. From Derby southwards to Rugby.
4th. From Derby south-west to Birmingham.

The disturbances on these four telegraphs were observed to occur simultaneously, with rare exceptions; and the direction of the current in the two telegraphs proceeding northerly and north-easterly was always contrary to those proceeding southerly and south-westerly; that is to say, when the deflection was such as to indicate that the current was towards Derby on the first two, it was from Derby on the last two; and when it changed in one it changed in all. It was also observed that on the 19th of March, 1847, there was an unusual degree of disturbance during the presence of auroræ boreales.

* Vide *Chemical Times*, page 330.

As these effects could not be attributed to the transit of ordinary atmospheric electricity along the wires to the earth, I determined to make a set of experiments on the subject.

Having obtained delicate galvanometers, I first ascertained that currents are at all times perceptible in the telegraph wires to a greater or less extent when the galvanometer is applied on a sufficient length of wire, and between two earth connections; but that wires having no earth connection, or only one, exhibited no currents.

I also found by simultaneous observations on two galvanometers, applied one at each extremity of a wire forty-one miles long, that the changes of force and direction of the currents were simultaneous at both ends, the current passing direct from one earth connection to the other.

But the most interesting fact which appeared during these observations, and that which bears immediately on the remarks contained in the letter of M. de la Rive, is, that there is a daily movement of the galvanometer needle, similar to that of the horizontal magnetic needle, produced by the electric currents travelling in one direction from about eight a.m. to eight p.m., and returning in the opposite direction during the remainder of the twenty-four hours. The times of zero are not regularly maintained, and vary from seven to ten o'clock both in the morning and evening; but the greatest regularity is observable in the morning, and the mean result of numerous observations is as above stated.

This regular diurnal movement of the galvanometer needle is subject to disturbances of greater or less force and duration, which are found to be of greatest energy during magnetic storms, and when aurora is visible; and in these cases the currents are so strong as to affect the ordinary telegraph instruments, and sometimes prevent altogether the transmission of messages.

The next experiments were made with a view to ascertain the direction in which these currents alternate; and the result, as determined from numerous observations, denotes it to be from north-east to south-west. The nearer this line is approached, the more decided is the effect on the galvanometer; but between east and south, and between north and west, the effect is smaller; and in approaching north-west and south-east it becomes indefinite and irregular, but never ceases entirely.

It also appeared that the effect depended not on the direction of the wire itself, but on the relative directions of the two earth connections; that is, the points where the wire was connected with the earth. I next made simultaneous observations with the galvanometers and a declinometer needle; from which it appeared, taking the mean of numerous observations, that that part of the day in which the currents flow southwards (that is, from eight or nine a.m. until the evening) the variation of the declinometer needle is westerly; and that during the night and early part of the morning (at which time the currents travel northwards) the variation is easterly; also that the large disturbances called magnetic storms are simultaneous on both instruments.

But, although there is this resemblance in the general features of the movements of both needles, the paths described are not similar. The movements of the galvanometer needle are more frequent and rapid than the declinometer, and the deflection frequently changes over from right to left without a corresponding movement of the declinometer.

The observations thus briefly recorded formed the subject of a paper which was read at the Royal Society on the 17th of June, 1847; and I have thought it desirable to make this communication to your journal on reading M. de la Rive's letter, because it rather curiously happens that the unusual delay which has arisen in the publication of my paper by the Royal Society is attributable to the fact that I arrived from these experiments at the same conclusion as M. de la Rive as to the electric origin of the diurnal variation of the magnetic needle, which I considered to be the effect of the alternating electric currents exhibited by the telegraph wires.

The Royal Society were unwilling to give their sanction to this view of the case, and only consented to the publication of the observations above described on my omitting that portion of the paper.

The paper is, however, now in the hands of the printers, and will, I hope, be shortly before the public.

I ought to state, in conclusion, that my idea of the origin of the currents differs, in one respect, from the theory of M. de la Rive; inasmuch as he considers them to arise in the atmosphere, whereas I have attributed them to thermo-electric action in the crust of the earth. I speak, of course, with great deference on a subject of this kind; but there is an important fact tending to this conclusion, which is now well ascertained, namely, that in the telegraphs which are laid entirely under ground deflections occur similar to those before described; while wires suspended in the air exhibit no deflections, unless they are connected with the earth in two places, and then the direction in which the current travels depends on the relative positions of the earth connections, however circuitous may be the route of the wire itself.

I am, gentlemen, your obedient servant,

W. H. Barlow, M.I.C.E.

Derby, April 12, 1849.

THE CHEMICAL TIMES.

SATURDAY, MAY 5, 1849.

THE INIQUITOUS PROCEEDINGS OF THE "HALL," AND MR. PYKE'S LETTERS AND ADVICE ON THE SAME.

So, it appears, we are to be treated to a whole batch of prosecutions, or rather persecutions, against chemists, and others, who, not having the fear of the great act of Rhubarb-hall before their eyes, will wickedly, illegally, and maliciously continue to attend and advise the sick, and to dispense and administer medicines, without being entitled thereunto by the inestimable right and privilege of appending to their respective names the apparently magical letters L.S.A.

The *professional* gentlemen who have chosen to put this modern engine of persecution in motion, and who seem to act in the matter *concurrently* with the master and wardens of Apothecaries'-hall, have selected the dispensing chemists and the holders of foreign diplomas as their first victims. They have as yet brought only two actions: the one of them successful, *because undefended;* the other a dead failure, *because defended.* This failure, however, has by no means abashed them; they regard it, in fact, simply as the consequence of a trifling flaw in the indictment, which they will take care in future to avoid: it would appear that the indictment charged Mr. Wells (the second intended victim of the "Hall" and the Medical Protection Society, or, as our respected contemporary, the *Pharmaceutical Journal*, felicitously terms them, "The Medical Bread and Cheese Society") simply with attending, advising, and *administering* medicines, but not with *dispensing* them; whereupon, the evidence adduced to fix the charge of attending, advising, and administering medicines being deemed insufficient by the jury to convict thereon, the defendant gained the day; whereas, had the charges included that of dispensing medicines, the chances might have been greatly in favour of the "master and wardens" pocketing another twenty pounds, and the *immediate* promoters (or, perchance, *promoter*) of the action enjoying the satisfaction of having brought to ruin a *successful rival*, increasing thereby their or his *own* stock of "bread and cheese."

In truth, were these proceedings not so thoroughly iniquitous, and, in the present state of "county-court law," so *seriously threatening* the welfare, nay, the very existence, of *thousands* of the profession, who do not happen to belong to the Apothecaries' Society, though the *intellectual* and *scientific* status of most of them would surely bear comparison (*at the least*) with that of *any* of the members of that society, one should almost feel tempted to laugh at their gross absurdity. Why, if the meaning and import of the act under which these prosecutions are brought are, indeed, such as the "master and wardens" and the "Protection Society" take them to be, there is, with the exception of the apothecaries, not a medical man in the kingdom who may not be pounced upon at any time for a twenty pounds penalty, and the "concomitants."

Fortunately it appears that the promoters of these most iniquitous proceedings labour under a considerable mistake regarding the *actual* law (*not* the County Court interpretations of it) of the case. We are exceedingly happy to lay before our readers, in our present number, a series of letters on the subject (from the pen of Mr. Pyke, the barrister) embodying *most valuable legal* advise to all who are, or may be, threatened with proceedings under the Apothecaries' Act. We are thoroughly convinced that the hints and suggestions thrown out in these letters will prove a *deathblow* to all future proceedings on the part of the "Hall"; and we beg to call the particular attention of our readers to Mr. Pyke's most generous offer to "hold himself at the *gratuitous* service of any member of the medical profession who may become the subject of any future process on the part of the 'Hall,' either by indictment or otherwise."

Our next number will contain another letter on the subject, in which Mr. Pyke will enter more minutely into the details of the *law* of the case.

APOTHECARIES'-HALL v. LOBO.

[To the Editor of the Chemical Times.]

Sir,—These are not times when medical practitioners should fall into troubled waters.

1. Upon what principle of law can the company depute another to bring an action for the £20?

2. What consequences would be entailed upon the "*trading*" company if it did?

3. Can more than *one* action be brought against the same defendant? If it can and should be attempted, then by what means could the defendant relieve himself?

4. Could not "grave" questions of the utmost moment to the company be raised upon a rule *nisi?*

5. Has it not been settled that an indictment may lie against a public company? If so, what would be the consequences in this instance, if found, tried, and verdict had?

6. Of what value is a County Court decision? *Quâ* County Court?

7. What does the ancient law upon a multiplicity of suits mean?

8. Do not manifold principles at common law (both on the Crown and civil sides) show, if brought to bear on the question, that the soundest and safest plan will be to forget the decision, and obtain a good Medical Bill, than fall back upon a decision that will "*ultimately*" produce nothing but disaster, by provoking questions that had better sleep? Let the profession think of this, and not push "*fanciful*" remedies at law "*too close*," or rely upon it, in this instance, "glass is beneath the naked feet."

Very faithfully yours,
H. H. Pyke,
Barrister-at-Law of Twelve Years' Standing.
87, Chancery-lane, and Verulam Chambers,
Lincoln's-inn.

"What dire offence from '*childish causes*' springs!
What mighty hubbubs rise from trifling things!"
Plutarch.

[To the Editor of the Chemical Times.]

Sir,—I shall never forget the advice given me by an eminent philosopher of the nineteenth century (Basil Montague, Esq., Q.C.), ten years since, on pressing upon him, in consultation, a point of vital importance. Mark his answer—"Mr. Pyke, let that soak; walls have ears." I have lived to estimate its value, and now impart it to others, or should have written to you immediately after the case appeared in the *Times*, 24th of February last.

1. This action was for a "penalty." Strange! passing strange! such an item should have found its way into the statute unaccompanied by the usual requisites.

2. Where does this penalty go, if recovered? To the examiners? to the public? or who? Surely not to the tradesmen—does it?

3. Has the Crown a right to put in a claim by the defect in the act? (*inter alia.*)

4. If yea, what becomes of the action—the Attorney-General being no party?

5. Funny verdict! funny result! no defence! no plea! no attorney! no counsel! judge puzzled! Fictitious actions are well known to conveyancers, and on the Crown and civil sides of the common law. Walls have ears. Mr. Editor, sometimes things should lie and soak when results are arrived at. Is that so here? looking at certain bold movements by third parties for private objects—and not the company.

6. This action is brought for a penalty, and must be a local action by the common law of England. Will the plaintiff company run into every county in England and Wales to get this pitiful penalty? If even they could succeed, how would it pay—when the costs are only a few shillings to obtain a verdict, but pounds, with ruinous results, if carried up to the court above (either on evidence or law)? Suppose the action should fail, what are the several remedies of the defendant?

7. If the action were really maintainable in a County Court it is still "local," and must be fought out where the defendant resides. What insanity, therefore, to raise the hue and cry on this miserable action! Vide the act and its clauses.

8. The truth must be told. I have long suffered in its advocacy, but, nevertheless, I shall go on. Why attempt to press the prescribing chemist and unqualified Englishmen of spotless reputation too hard? Rely upon it, every prescribing chemist more or less plays into the hands of the qualified man; destroy this useful body, and you will witness that by wholesale which I now see by retail, viz., Scotch and Irish graduates, who turn up their nose at the hall and college, and vault into the saddle of the chemist you now seek to destroy! Here I again stop, as the fatal consequences I could further unfold thicken upon me; and I must respect your space, simply adding that, to my knowledge, there are places in England where the qualified men feel it their happiest privilege to pull with unqualified men; and many, very many, partnerships are there of this very description.

9. My firm impression is, the more I look into this action of the Apothecaries' Company v. Lobo, the more I am impressed that that company are not the real and prime movers: they have merely permitted their corporate name to be used with probably the best motives, not being aware of the legal results, and the real object sought to be obtained by and through those parties for mere private purposes, which they know will be thoroughly shattered when the profession are protected by an act of Parliament.

Very faithfully yours,
H. H. Pyke.

N.B. What principles could be raised on the Crown side of the common law against those who countenance or contribute to these actions?

"In law, what plea so tainted and corrupt,
But, being season'd with a gracious voice,
Obscures the show of evil?
* * * * * *
in a word,
The seeming truth which cunning times put on
To entrap the wisest."
The Merchant of Venice, act 3, scene 2.

"Persecution appears in many shapes, but has never been successful in extirpating opposition to any system. * * The human mind is roused by oppression."—*Zimmerman.*

"Coercive measures never yet made a convert to any opinion, but either martyrs or hypocrites."—*Pinnock.*

"Can such things be,
And overcome us like a summer's cloud,
Without our special wonder?"
Macbeth, act 3, scene 4.

[To the Editor of the Chemical Times.]

Sir,—I now address you on high professional policy, also on most distinguished public grounds.

1. Is not this "pitiful and despicable un-English" action against Lobo, a "foreigner," already producing bitter fruits to "home" practice, and opening the eyes of the public in more ways than one, viz., to the secrets of the charnel-house?

2. Is not the ensuing Medical Bill endangered, if not likely to be lost, by it?

3. Are not the Irish and Scotch graduates, foreign diplomas, and unqualified men, but of long standing, taking fire, and severally combining in self-defence?

4. Are not the Irish and Scotch M.P.'s proverbially stanch to their countrymen, particularly in professional matters?

5. Has not provision for civil war, therefore, commenced in the very vitals of the profession?

6. Who are the authors of all this? Has not persecution applied the torch?

7. Have not Irish distress and the Northern Railroad been almost daily adding to the number of combatants and to the expected confusion?

8. Has not Mr. Baines, C.P.L.C., sanctioned Scotch diplomas taking English medical districts? (The Whitechapel appointment for instance.) And has not this Scotch gentleman got sanctioned the workhouse dispensary?

9. Do not Scotchmen die hard? Will they "give up this vantage ground" on this now recognised principle? The Scotch claim rights by reason of their political incorporation, and we see these rights at once conceded to them!

10. Have not the Irish a right to say why, then, are *we* excluded?

Quere. How are the above remarkable points to be evaded or got over? Alas! such are the bitter fruits of strife and persecution; and how strikingly do we see exhibited here the truth of the old adage, "When principles are erroneous they will produce erroneous practice"?

11. A public trust must have, and can have, no private or personal interest. Are not the "trading" shareholders constituting the Society of Apothecaries, in a corporate capacity, simply a mere private trading, money-making body?

12. Is not this body, therefore, utterly deficient in every essential character of a high public trust?

13. Can it in law, in any way, call on the courts to carry out its rules for the public weal through a public officer, *i.e.*, the Queen, or the Attorney-General? It has no power of the kind. On what ground, therefore, is a penalty enforceable? Penalties are for public offences, not for private gain!

14. Does it not, on the contrary, but degrade itself by acting as plaintiff to obtain £20 penalties (without giving any public *quid pro quo*), and when recovered (in the "joint" character of prosecutor and plaintiff) apply the proceeds to its own "private," corporate, or shareholding use, contrary to all public policy or moral right?

15. By this act do not both defendant and public suffer under colour of law, and both drugs and law become sources of pecuniary profit at the expense of high public and professional principle, in a manner in every way repugnant to sound public policy?

16. Let the lawyers of England—ye 4,500 counsel and 13,500 solicitors—read this! Fancy their stationers, incorporated by act or charter, claiming to regulate "the highway of professional admission, together with examination prior to practice," with power to "pluck," and fixing at any moment a £20 penalty under any alleged breach of their mere conventional law (nothing better), through a local action of a county court summons, which, if undefended, would lead to the recovery and private application of the money. Fancy also, in addition to this, the stationers exercising a concurrent right with the barristers, and using the toga; in fact, a stationer and a barrister to be one! A trade and a profession entwined, and with high examining responsibility attached; and this will nearly, if not quite, realize the present singular and anomalous position of the London City Apothecaries' Trading Company.—N.B. It is strange the other City trading companies do not follow the footsteps of the Apothecaries (and what is to prevent them?) in nearly every respect, and "make confusion still worse confounded"? Fortunately, public opinion has recently checked them, and this in the matter of the city of London itself. The real professional status resides undoubtedly in the Colleges of Physicians and Surgeons; but these bodies are powerless (and are themselves cowering) in the matter; and the Lobo law, if it could for a moment stand its ground, might, in several ways, level both physician and surgeon tomorrow (which will, no doubt, hereafter be attempted). Why wonder at the heartburnings in the profession, and in every branch of it, on this state of things?

17. What law and consequences attach to a mere private right, distinguishable from a public one (say in the present case)? When fully answered, place such answers in juxtaposition to the assumed rights of the company, and what becomes of this farcical action of Lobo?

18. Are frauds under colour of law unknown to the books or courts? Are such things as knowingly selecting a wrong and minor jurisdiction, or throwing dust in the eyes of a judge, rare?

19. Is there the slightest principle or remotest clause in the County Court Act depriving the superior courts of jurisdiction over a cause of action involving principles of such stupendous importance and magnitude as the rights and welfare of several thousands of professional men, sought to be destroyed by a legal "lurch," through the agency of this undefended action of Lobo, followed up by declarations and printed intimations in the *Times* and medical press, which, if not counteracted by my exposures, must, and will, produce hereafter the most disastrous result and wholesale ruin to thousands of professional families by so ridiculous and arbitrary and despotic a power?

20. Is it not true that pleadings of the most special character, based upon equally solid principles, can be drawn and will apply to an action for this £20 penalty, on which issues can be raised upon the pseudo rights of the trading company, "which would strike at the very root of its (alleged professional) existence"? But, it appears to me, to evade these pleadings, and the ruinous disclosures and results of a well and just fought battle, and final solemn decision from the mouths (probably) of the fifteen judges,

this highly condemnatory proceeding before an humble County Court has been resorted to for purposes of mere terror and costs! costs! costs! both openly and glaringly avowed, and to enforce the contemptible £20 penalty; to me this seems only the commencement of the evil, merely the advanced guard for sterner objects in reserve and of crushing import.

21. Ought questions of the present transcendant nature to be so smothered, and the right of the public and the profession to be thus undermined, and be withdrawn from the high and recognised tribunals of the country, "to serve a mere private or party purpose"? We have all seen openly and exultingly published, as the fact appears to me, "that a mere body of London tradesmen can, and will, for a mere private purpose, and in any part of England and Wales, at any moment, enclose and roll up within the meshes of its trading net any highly-qualified scientific medical man, because he is either too poor to pay, or has not submitted to their rules and paid their fees," and hold (how monstrous!) in terrorem a blighting, withering, and blasting power over the Colleges of Physicians, and Surgeons, chemists, foreign, Scotch, and Irish diplomas?

Surely this cannot be; and yet Lobo's action says yes. How ridiculous it appears when thus tested by first principles!

Finally, I beg to add, as a member of the bar of England, I never took a greater pleasure in showing up what I know and feel to be a gross abuse of the process and jurisdiction of the courts, the statutes of the realm, and the common law of the land. In this instance a most iniquitous proceeding has been resorted to against a poor foreigner, and the results of this proceeding are threatening in the extreme to the whole body of the medical profession, individually and collectively. I hereby hold myself at the gratuitous service of any member of the noble profession of medicine who may become the subject of any future process, either by indictment or otherwise, in order that the question may be fairly fought through (if needs be, by public subscription) its various stages, and decided by "the only competent tribunal" before whom it ought to go, instead of being "burked" in a mere shopkeepers' court below,—a court essentially created "for tradesmen's debts," and not for settling professional precedence, status, etiquette, and high professional rights; and so strong is the feeling of Westminster-hall on the subject, that in many instances the courts have held that neither barrister nor attorney shall be brought within the County Court jurisdiction, even for the recovery of a simple debt, if he chose, on certain terms, to plead professional usage; and a court of equity would also interfere by injunction.

Very faithfully yours,
HENRY HUGH PYKE,
Barrister-at-Law of Twelve Years' Standing,
Originator of the Legal Education Movement, also of Medical Progress.
87, Chancery-lane, and Verulam Chambers, Lincoln's-inn, April, 1849.

That our readers may fully understand the import and bearing of the preceding letters, we subjoin the reports of the two actions of the Apothecaries' Company respectively v. Lobo and v. Wells:—

COUNTY COURT OF MIDDLESEX.

THE APOTHECARIES' COMPANY V. LOBO.

This was an action brought by the master and wardens of the Apothecaries' Company against Raphael Louis Lobo for the recovery of a penalty of £20, forfeited by him for practising as an apothecary, contrary to the provisions of the 55th George III., c. 194. The case is of the greatest importance as establishing a precedent for a new and more efficacious mode of proceeding against unqualified medical practitioners, who have hitherto evaded the law by reason of the expense incurred in suing them for penalties in the superior courts at Westminster.

Mr. J. A. Griffits appeared as counsel for the plaintiffs, and Mr. Lobo conducted his own defence.

The defendant took a preliminary objection on the ground of misnomer, but, the learned judge having directed the record to be amended, the case proceeded.

Mr. Griffits said that he availed himself of the valuable jurisdiction of the County Court to recover from the defendant the penalty of £20, which all persons illegally practising as apothecaries were liable to under the 55th George III., c. 194. The plaint was laid under the 20th clause of that act.

Mr. Sergeant Heath asked the learned counsel if he was quite sure that the County Court had jurisdiction in the matter, as he was not quite satisfied on that head?

Mr. Griffits quoted the case of "the Apothecaries' Company v. Lolinga," 2 M. and R., p. 499, in which Mr. Justice Cresswell defined an apothecary as a person who professed to judge of internal disease by its symptoms, and applied himself to its cure by medicines. In "Woodward v. Ball," Car. and Payne, p. 578, Mr. Justice Williams held that the practising as an apothecary was the mixing up and preparing of medicines prescribed by the party who did so. The county courts were courts of record, and the 26th clause of the 53d George III., c. 194, *gave the Apothecaries' Company power* to proceed against unqualified apothecaries, by action or suit at law, for penalties to the amount of £20. The sooner the question was decided the better, both for the profession and the public, who were equally interested that proper securities should be afforded for the employment of regularly qualified medical men. In the case of "the Apothecaries' Company v. Allen," 4 Bar. and Ad., p. 626, Lord Denman said that a person compounding medicines and selling them, though he did not make out prescriptions like a physician, nor kept a shop, acted, nevertheless, as an apothecary, in the ordinary sense of the word, and that it made no difference if he prescribed as well as prepared his medicines. This opinion was confirmed by the whole court, and might, therefore, be taken as settled law. He was instructed that the defendant had attended Alexander Reeves, and given the registrar of the district a certificate stating the cause of his death. The patient appeared only to have lived three days, which might, perhaps, lead to the inference that not only was there want of legal qualification, but also a great want of medical skill. The certificate contained a printed notice in these terms:—"If this form should fall into the hands of any unqualified practitioner, he is recommended not to fill it up."

Mr. Sergeant Heath asked if the act provided that none but properly qualified apothecaries should sign such a certificate?

Mr. Griffits said it did not, but the practice was that no registrar would knowingly receive a certificate from any but a duly qualified practitioner. There being some doubt entertained in this case as to the qualification of the defendant, a letter was written to him by the registrar desiring to know by what authority he took upon himself to sign such certificates. To this he wrote in reply, alleging that he had obtained a diploma as doctor of medicine and surgery from the University of Giessen. He, therefore, had nothing but the certificate of a foreign university, which could not be made available in England, for there were cases to show that even Scotch diplomas and certificates were not legal qualifications under the act, and this defence, therefore, could not be sustained. He had been instructed that the defendant admitted the charge, and had thrown himself upon the mercy of the plaintiffs.

Mr. Sergeant Heath read, from a paper which had been handed in by the defendant, a statement by him, that he had made the admission alluded to upon the representation of Mr. Eyre, the solicitor for the plaintiffs, that if he did so further proceedings should not be taken; but, having found that the Apothecaries' Company would not abandon their proceedings, he had thought proper to withdraw that admission and endeavour to defend himself.

The learned judge said he was willing to accede to anything the parties desired, if it would meet the justice of the case.

Mr. Griffits said the Apothecaries' Company were a public body, and could not, consistently with their duty, enter into any compromise; but they had no wish to press the case with any degree of harshness against Mr. Lobo. They were, therefore, willing to take judgment for the penalty and the costs. The costs out of pocket only to be paid by the defendant. In the meantime no execution would be issued, the defendant promising not again to practise as an apothecary while he remained unqualified.

The defendant having assented to these terms,

Mr. Sergeant Heath said: I think the Apothecaries' Company have acted very rightly in bringing this case before the public, and very rightly also in refusing to enter into any compromise. Let an order be made for the full amount of £20, and costs, to be taxed. On payment of taxed costs all proceedings to be stayed until further order of the court. No order will be made unless it is shown to the court that the defendant has broken his promise, in which case the judgment will be enforced.

COUNTY COURT OF BLOOMSBURY.

THE MASTER AND WARDENS OF THE APOTHECARIES' COMPANY VERSUS WELLS.

This was an action in the Bloomsbury County Court to recover the penalty of £20, under the 20th section of the 55th George III., cap. 194. A *certiorari* had been granted by Mr. Justice Patteson, on application of defendant, to remove this plaint to the Queen's Bench, but an order was afterwards made, on the application of plaintiff, to quash the same unless defendant gave security for costs, which he declined doing. Accordingly, the cause was tried in the County Court (Berners-street) on the 19th of April.

The charge in the plaint was that the defendant "did act and practise as an apothecary, to wit, at Grove-street, Camden-town, in the county of Middlesex, by then and there acting as such apothecary, attending, and advising, and furnishing, and supplying medicines to and for the use of certain persons (to wit), one Jane Reeks, since deceased, and Jane Reeks, the mother," &c., without having obtained such certificate, &c. &c.

Mr. Griffits appeared as counsel for the plaintiffs, and Mr. W. V. Eyre as their solicitor; counsel for the defendant, Mr. Corrie; solicitor, Mr. Frederick Asprey, No. 6, Furnival's-inn.

Before opening the case, Mr. Griffits requested the judge to order the witnesses out of court, which request his honour complied with. He commenced his address by an allusion to the origin of the Worshipful Society of Apothecaries, a body which had existed about two centuries and a half, having been originally separated from the grocers, and having rendered essential service to the public by the improvements they had introduced in the science of medicine, more especially of late years. Having adverted to the responsible duties of the apothecary, and the act of 1815 (55 Geo. III.), he appealed to the jury to assist in protecting the public against the calamitous effects of ignorance in persons illegally assuming the office of an apothecary. It was the bounden duty of the worshipful company which he had the honour to represent to come forward in cases like the present—they had no alternative—they were bound by the act of Parliament (of 1815) to exercise the powers entrusted to them for the suppression of practice by unqualified persons. The present case was only the first of this description which had been tried. The question at issue in previous cases had related chiefly to the distinction between medical and surgical practice, and persons who could legally practise as surgeons had been prosecuted for acting as apothecaries, in proof of which it was necessary

to demonstrate that the disorder treated was a medical and not a surgieal one, and that defendant had attended and administered, or furnished, the remedies. In the present case defendant was a chemist, and it would be proved, by incontestable evidenee, that he had acted as an apothecary in a ease of eonsumption, which was undoubtedly a medical case, that he had attended the patient and furnished the medicines. It would be proved that he had repeatedly visited the patient, and, although it was possible that an attempt might be made to weaken this testimony by a counter statement, yet this would not affeet the general issue, since the aet of eompounding the prescriptions, which was not denied, rendered the defendant equally liable to the penalty under the aet. Now, as to the duties of an apothecary, it was stated in the 5th section of the act above cited that it is the duty of an apothecary "to prepare with exaetness and to dispense such medieines as may be directed for the sick by any physician lawfully licensed," &c.; the same clause further enacted that any apothecary refusing so to dispense, or falsely or unfaithfully dispensing, such medieines, should be liable to a penalty of £5 or £10. Consequently, it was obvious that any person not being duly qualified to act as an apothecary, who should presume to dispense preseriptions, was liable to the penalties imposed by the act. Now, it was further provided by the said aet that, for the seeurity of the public, the master and wardens of the said Company of Apotheearies should have the power of visiting apothecaries' shops, examining the medicines, and destroying such as might be found unfit for use. This would explain the ease of the prejudice in favour of ehemists and cheap physic, for these persons, not being subjeet to such supervision or control, and not being obliged to undergo any education, could sell medicines of any quality, and could of eourse supply trash at a much lower price than the apothecary eharged for the genuine articles which the law obliged him to dispense. The learned eounsel eoneluded the introductory portion of his eloquent and imposing address by assuring the jury that, under any circumstances, the plaintiff was entitled to a verdiet, whether the whole eharge was proved or not, the dispensing of prescriptions being as mueh a violation of the law as visiting patients. In applying these remarks to the facts of the case, he eommeneed by deseribing the defendant as an uneducated person, who had not been apprenticed, and was in every respeet unqualified.

Mrs. Harris examined: Witness saw Jane Reeks, who was taken ill on the 10th of November. Defendant ealled and preseribed for her. He ealled several times, felt her pulse, looked at her tongue, &e. Did not hear him say what the complaint was. Heard him order the windows to be shut and a fire to be lighted. Was surprised at these orders, as Mr. Collins had ordered free admission of air for my ehildren, who were ill at the same time. Went to defendant's shop with Mrs. Reeks, who brought away some medicine. Did not see it prepared. Defendant did not attend the ehild after the 13th. Mr. Godwin was attending at the time the child died.

Cross-examined: Saw defendant three or four times attending the patient. He always came alone. Mr. Collins attends my family. He has a shop, like a ehemist's shop, a few doors from defendant. He lives in Park-street. His brother is at the shop in High-street.

Henry B. Collins (in answer to Mr. Corrie): I am not the informer.

Examination in chief: I am assistant to my brother, who is a surgeon. He lives in Park-street. I reside at the surgery in High-street. I know defendant. Can identify his handwriting. Part of that certifieate (of the death of Jane Reeks) is his handwriting; the signature is by Mr. Godwin. These bills are in Mr. Wells's handwriting:—"Medieines, &e., 12s. 6d." "Bill delivered, 11s. 6d." "Medicine for child, 7s. 6d."

Cross-examined: My brother does not keep a shop, but a surgery. It is not like defendant's shop. We do not expose articles for sale. The words, "Preseriptions faithfully Prepared," are not in the window. Cannot swear that the words "Chemist and Druggist" are not over the shop. Believe the words in the window are, "Prescriptions carefully Prepared." I have dispensed preseriptions some four or five years ago. Will not swear that I have not dispensed prescriptions within the last four months. I am not an apothecary. My brother is not an apothecary. I have dispensed medicine ordered by him.

Mr. O'Reilly: I am not the informer. I am a surgeon. I passed the shop of the defendant on the 10th of March, and ealled with Mr. Eyre, the solicitor for the plaintiffs, to caution the defendant about practising. He was dispensing medieine, which I told him was illegal. Defendant denied having practised as an apothecary.

Mr. Corrie, on behalf of the defendant, in a very able address, explained the state of the law in reference to the practice of an apothecary. He did not think it requisite to dive into the remote periods of history, but adverted to the origin of the act of 1815. The proceedings which led to this act commenced about the year 1813, when a bill was brought in for regulating the practiee of apothecaries. The ehemists, fearing lest some provisions might be introduced interfering with their business, formed themselves into a committee to protect themselves, and insisted on the insertion of a elause exempting them from the operation of the aet. In eonsequence of this opposition a elause was prepared; and the following extract of a letter from the solicitor of the Apotheearies to the chairman of the ehemists' committee would serve to show that there was no intention of interfering with chemists:—

"Sir,—We are instructed by the committee of the Society of Apothecaries to forward you the clause which they propose, at the requisition of the eommittee of your body, to introduce into the act now before the House of Commons, and which, we trust, will meet the wishes of the parties whom you represent.

"The eommittee of the Society of Apotheearies see with concern that misrepresentations have been made of their objeet, which is the improvement of their branch of the profession in medical knowledge. To this their views are so entirely directed that they have no disposition to insist on any clause whieh is not essentially eonnected with it."

The clause, with some little alteration, was agreed to, and is the 28th clause of the act, reserving to chemists all the rights and privileges they enjoyed before the passing of the aet. To suppose that the act was intended to interfere with the right of chemists to dispense prescriptions was a notion too monstrous to be entertained for a moment. In looking over the report of the proceedings in 1815 (in the "Historieal Sketch of the Progress of Pharmacy," by Mr. Jacob Bell), the names of many of the committee were names known at the present time as chemists and druggists; in faet, the business had been handed down from father to son, and continued without interruption; and could it be supposed that all these parties and hundreds in the metropolis, and indeed all over the country, were to shut up their shops? If this were the intention of the aet, what has the Worshipful Society of Apothecaries been doing sinee the year 1815? It was clear that the said society could not be cognizant of these proceedings, whieh, in faet, were undertaken by a new body lately started under the name of the "Medical Protection Society," and the object of these proeeedings was obvious. The dispensing of prescriptions being a luerative branch of the business, and the eharges of apotheearies very high, they naturally desired to engross all this profit to themselves, instead of allowing the publie to obtain medicine at a reasonable rate from chemists, who, as a body, were better qualified to dispense prescriptions than most apotheearies. The learned counsel denounced as unjust and untrue the sweeping charge against the defendant of ignorance and ineompetence with which the counsel on the other side had commeneed his case, and stated that he was prepared to prove that Mr. Wells had served a regular apprentieeship, and had also served for several years as assistant to Mr. Collins. In referenee to the case before the eourt he should prove that defendant did not visit the patient, that he merely dispensed the prescriptions in the eapacity of a ehemist, which he had a perfect right to do, the said prescriptions having been written by a qualified practitioner, who had attended the ease. He would prove by the evidenee of respectable chemists, who were in business before 1815, what was the custom of the trade at that time, and thus plaee beyond all doubt the fact that the claim set up by his learned friend was monstrous and unjust, and that his client was on every ground fully entitled to a verdiet.

John Knaggs examined: I am a surgeon and apotheeary. I know the defendant—have frequently recommended patients to his shop—have also attended patients sent by him to me, and he has prepared the preseriptions. I attended Jane Reeks for diarrhœa; she was sent to me by defendant—she recovered. I was apprenticed before 1815. Chemists at that time were in the habit of preparing preseriptions—they sometimes gave advice across the counter.

Cross-examined: I am fifty-seven years of age. I was apprenticed in Lancashire to Mr. Mounsey. He practised as an apotheeary before the act—afterwards he merely acted as a chemist. I consider the distinetion between an apothecary and a ehemist to be, that an apothecary goes out to visit patients, a chemist dispenses medicines at home. I became a licentiate of Apothecaries'-hall some years afterwards. It is necessary in passing the hall to produce indentures of apprenticeship with an apothecary.

Mr. Griffits: And you passed off your indentures at the hall when you say that your master was only a ehemist! You are liable to a prosecution—your licence is not worth a rush—this is disgraceful.—Witness: Mr. Mounsey praetised as an apothecary before the act.

Sarah Muffit: In November last I was landlady at 6, King-street. Mrs. Reeks was my lodger. About the 6th of November my children were ill. Mr. Godwin attended. Mrs. Reeks had a child ill. I advised her to consult Mr. Godwin, and he attended several times. Mr. Wells never came to the house but onee, and then he came with Mr. Godwin to look at my child's eye—he did not prescribe, but advised me to consult an oculist. I always saw Mr. Godwin when he eame. He attended until the death of the child.

Cross-examined: I went to Mr. Wells's shop to see Mr. Godwin. I waited for the medicine to be prepared. I was there yesterday with Mrs. Reeks, Mrs. Leech, Mr. Godwin, and Mr. Wells's attorney. Mr. Wells was there part of the time.

Mr. A. Garden: I am a chemist, residing in Oxford street, sixty years of age. I was apprenticed about the year 1810. I remember the passing of the act in 1815. I am not an apothecary—never attended patients. Chemists before 1815 dispensed prescriptions, and occasionally gave a little advice over the counter in trifling cases. I was never very fond of giving adviee. I am an operative and dispensing chemist.

William Howse, ehemist, Titchbourne-street: Was born in 1794. Recollect the passing of the act in 1815. It was universally the practice at that time for chemists to dispense prescriptions, and occasionally to give adviee. The regular business was dispensing. They did not visit patients as medical men. I understand the distinetion between a chemist and an apothecary to be that a ehemist prepares and dispenses medicines; an apothecary visits the sick, studies dis-

ease, and administers remedies for such disease.

Louisa Leech: Saw Mr. Godwin attend the child several times.

Margaret Reeks: Mr. Godwin attended the child. I took the prescriptions to Mr. Wells to be made up. Mr. Knaggs attended before, and I took his prescriptions to Mr. Wells. Mr. Godwin was recommended by Mrs. Muffit when my child was ill in November. Mr. Godwin wrote prescriptions. I never paid him anything. I paid Mr. Wells 1s. on account. I remember meeting Mrs. Harris, and she treated me to some gin. She asked me for Mr. Wells's bills. I gave one to her then and the other in the evening. Knew Mr. Collins through Mrs. Harris. When I gave up the bill I was so intoxicated that I did not know what I was doing. Mr. Godwin attended me always. Mr. Wells did not tell me to light a fire and shut the window.

Cross-examined: Mr. Wells never called but once. The medicine was sent. I consulted Mr. Wells once, and he said he would have nothing to do with the case, but sent me to Mr. Knaggs. The bill is for Mr. Godwin's attendance and the medicine. We had several glasses of gin that day. My husband said he wished I would break off from the gang that I was mixed up with.

Mr. Corrie: What gang? The Apothecaries' Company?—Witness: No, not them.

James Young Godwin (surgeon and apothecary): I reside in Mr. Wells's house. I was not residing there in November last. I attended Mrs. Muffit's child, and afterwards Jane Reeks. These are my prescriptions. I also wrote other prescriptions for the patients. The price charged in the bill is a very moderate charge, not more than a chemist would charge for the medicine. I signed the certificate of the death; Mr. Wells put in the name and age.

Cross-examined: I first attended the child about the 10th of November. I attended Mrs. Reeks subsequently. I first became acquainted with Mr. Wells by going to have prescriptions made up. I have seen Mrs. Reeks at his shop, and prescribed for her. I read over the evidence to the witnesses. I obtained it from Mr. Asprey.

Mr. Griffits in his reply laid much stress on some discrepancy which had occurred on cross-examination between the testimony of the witnesses for the defence, chiefly in reference to a consultation which had taken place before the trial, and argued from this circumstance that their evidence was not to be relied on. He maintained that the testimony of Mrs. Harris fully proved the attendance of defendant as an apothecary, and that, whether he had attended or not, he was equally liable to the penalty for preparing the prescriptions, arguing that although chemists dispensed prescription before 1815 they did so by usurpation, and not by right.

Mr. Sergeant Heath summed up at some length, and, while he admitted some incongruity to exist in the testimony, he left it to the jury to determine whether or not this would affect the general issue. He directed the jury to confine their attention to the question of attendance as an apothecary; the other question, namely, the right of chemists to dispense prescriptions being too serious a matter for that court to adjudicate upon, especially as the act of Parliament had been in force so many years without any interference of this kind on the previous rights of chemists. He observed that a single act did not of necessity imply the adoption of a business or calling, as, for instance, in regard to the bankruptcy laws, where it was necessary to prove that the party was in trade, the fact that he had sold one horse, or even half-a-dozen horses, did not constitute him a horsedealer. It must be proved that he sold horses habitually as a matter of business. The same principle applied more or less to this case. A chemist might casually administer a dose of medicine to a patient for a sore throat, or other incidental ailment, without being liable to the charge of practising as an apothecary; but if he made a practice of attending patients he would clearly come within the provisions of the act.

The jury immediately returned a verdict for the defendant. On a question arising as to costs the jury interposed, giving their opinion that it was a case in which the defendant was fully entitled to his costs.

The trial occupied from about half-past ten a.m. till seven p.m.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Elias Robison Handcock, of 16, Regent-street, London, and Rathmoyle-house, Queen's county, Ireland, Esq., for certain improvements in mechanism, applicable to impelling and facilitating the propulsion of vessels in the water; which improvements are applicable to locomotive engines for railways, and other similar purposes. Patent dated October 12th, 1848. Enrolled April 7th, 1849.

This specification relates to certain improvements in the construction of that class of steam-engines known by the name of "rotary engines;" or where motion is conveyed direct from the working piston to the shaft, or other recipient of steam power. The engine constructed upon the patentee's plan, consists of a three-sided annulus or cylinder, with the piston attached to it, and bolted, or otherwise secured by slots, to the main driving shaft; the fulcrum against which the steam acts being periodically presented and withdrawn by the motion of the engine. The annulus or cylinder is supported and secured to the shaft by arms, in the manner of an ordinary wheel; a solid block of metal, acting as a piston, is firmly secured permanently steam-tight to the three sides of the annulus or cylinder. When the engine is in motion, the cylinder, the arms, and the piston, all revolve with the driving shaft. A recess is formed on the outward side of the piston for the reception of a curved spring; the convex side of this spring presses a plate of soft metal against a stationary plate; this packing is to prevent any steam passing by the piston during its revolution; the stationary plate consists of a circular plate of metal, cast with flanges, forming the bed for a packing round the cylinder. The packing is arranged in the following manner:—Between the cylinder and the stationary plate, and directly over the joining of the two, is fixed an annular plate of gun metal, or some other suitable soft metal; upon this plate a packing of hemp or asbestos is placed; outside this soft packing is a second plate, which is pressed up by a broad ring, adjusted by set-screws passing through it into the solid part of the cylinder with which it revolves. To prevent the lateral pressure of the steam forcing the stationary plate away from the cylinder, and thus allowing the steam to pass by the piston, it is pressed up to the cylinder by supporting arms, which are cast on, or bolted to, standards; provision being made in the supports (by means of slots) for preventing the stationary plate from revolving with the cylinder; this plate is supported also by a framing. The valve-box is situated at the side of the engine, and secured to the stationary plate. The fulcrum against which the steam acts is a block of metal, cast with recesses on either side, in which a metal packing is placed, and forced outwards by spiral springs. This fulcrum is alternately presented and withdrawn from the interior of the cylinder by a connecting rod, worked by a cam and friction roller on the driving shaft; the said plate being retained and pressed against the interior of the cylinder (when not acted upon by the cam) by a spiral spring. The patentee also proposes to work the steam-valves expansively, by means of a graduated moveable cam, dovetailed, or otherwise secured to the driving shaft. In case of two engines of this description being used for the propulsion of vessels with the screw propeller, or paddle wheels, or in any other case where two engines are required to work upon one driving shaft, it would be necessary to place the cams which work the fulcrum plates at right angles with respect to each other upon the shaft, in order that the power may be given off to the driving shaft with regularity, as in the ordinary reciprocating marine engines now used.

The construction may be slightly modified also in this point, that, instead of the side plate (against which the piston presses in the engine just now described) being stationary, the annulus or cylinder is formed like the letter U, the stationary plate being opposed to the piston at the periphery, or outer face of the annulus. The valve-box with its appendages would, in this arrangement, be fixed upon the stationary periphery of the cylinder.

After describing the nature of his invention, and the manner in which the improvements embodied therein can be practically applied for the purpose of propelling vessels, or of driving stationary machinery, the patentee wishes it to be understood that he does not claim as new all the various parts described in the construction of a rotary engine, as many of them have been used before; neither does he confine himself to the angular sectional form of the annulus or cylinder, as a curved form, or a variety of other forms, might be substituted for it. But he claims the general arrangement of all the parts described as shown and explained. He claims more particularly the forming the cylinder in such a manner as to present only one rubbing surface, as described; also the use of the piston permanently fixed on three of its sides to the cylinder, and revolving with, and in the direction of, the driving shaft, to which the cylinder is secured.

Secondly, the stationary side plate with the flanges, as described, for the purpose of forming a recess or bed for the reception of a steam-tight packing, as described; also the braces or supporting arms and the standards.

Thirdly, the application of rotary engines, as described, keyed, or otherwise secured to the driving axle of a locomotive carriage on railways, or common roads, for propelling such carriages without coming in contact with the ground, or using any auxiliary power or fulcrum beyond that supplied by the bite of the periphery of the wheels upon the rails or road.

Fourthly, the annular plate of soft metal forming a bed for the soft packing; also the ring for pressing up this packing, and the manner in which the outer side of the piston is made steam-tight by the curved spring and plate of soft metal, as described.

PATENTS RECENTLY GRANTED.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND FROM THE 22D OF MARCH, 1849, TO THE 21ST OF APRIL, 1849, INCLUSIVE.

Charles Henri, of Paris, in the Republic of France, manufacturer, for improvements in preventing the oxidation of iron. Sealed 26th March, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for hulling and polishing rice and other grain seeds. Sealed 26th March, 1849; six months.

James Fletcher, of Salford, in the county of Lancaster, manager at the works of Messrs. William Collier and Co., of Salford aforesaid, machinists and tool-makers, and Thomas Fuller, of Salford aforesaid, a partner in the said firm, for certain improvements in machinery, tools, or apparatus for turning, boring, planing, and cutting metal and other materials. Sealed 26th March, 1849; four months.

Walter Neilson, of Hyde-street, in the city of Glasgow, engineer, for a certain improvement or certain improvements in locomotive engines. Sealed 27th March, 1849; six months.

Jean Adolphe Carteron, of Paris, in the Republic of France, now of the Haymarket, in the

county of Middlesex, chemist, for certain improvements in dyeing. Sealed 27th March, 1849; six months.

David Henderson, of the London Works, in the parish and county of Renfrew, Scotland, engineer, for improvements in the manufacture of metal castings. Sealed 29th March, 1849; six months.

William Longmaid, of Beaumont-square, in the county of Middlesex, gentleman, for improvements in treating the oxides of iron, and in obtaining various products therefrom. Sealed 4th April, 1849; six months.

Francis Hay Thomson, of Hope-street, in the city of Glasgow, North Britain, M.D., for an improvement or improvements in smelting copper and other ores. Sealed 11th April, 1849; six months.

Clemence Augustus Kurtz, of Wandsworth, in the county of Surrey, gentleman, for certain improvements in looms for weaving. Sealed 11th April, 1849; four months. (Communication.)

Barthélemy Thimounier, ainé, of Amplepuis, Department du Rhône, in the Republic of France, engineer, for improvements in machinery for sewing, embroidering, and for making cords or plaits. Sealed 11th April, 1849; six months.

Alfred Vincent Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in the manufacture of piled fabrics. Sealed 13th April, 1849; six months. (Communication.)

Arthur Dunn, of Dalston, chemist, for improvements in ascertaining and indicating the temperature and pressure of fluids. Sealed 13th April, 1849; six months.

Jeremiah Brown, of Kingswinford, in the county of Stafford, roll-turner, for certain improvements in rolls, and machinery used in the manufacture of iron, also in rolls and machinery for shaping or fashioning of iron for various purposes. Sealed 13th April, 1849; four months.

William M'Bride, jun., of Sligo, in the kingdom of Ireland, but now of Havre, in the Republic of France, merchant, for improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water. Sealed 16th April, 1849; six months. (Communication.)

John Ruthven, Edinburgh, Scotland, engineer, for improvements in preserving lives and property from water and fire, and in producing pressure for various useful purposes. Sealed 17th April, 1849; six months.

William Henry Balmain and Edward Andrew Parnell, both of St. Helen's, in the county of Lancaster, manufacturing chemists, for improvements in the manufacture of glass, and in the preparation of certain materials to be used therein; parts of which improvements are also applicable to the manufacture of alkalis. Sealed 17th April, 1849; six months.

Charles Alexandre Broquett, of Rue Neuve St. Nicholas, St. Martin, in the Republic of France, chemist, for improvements in printing and dyeing fibrous and other materials. Sealed 20th April, 1849; six months.

Soren Hjorth, of Jewry-street, Aldgate, in the city of London, for certain improvements in the use of electro-magnetism, and its application as a motive power, and also for other improvements in its application generally to engines, ships, and railways. Sealed 20th April, 1849; six months.

James Hart, of Bermondsey-square, engineer, for improvements in machinery for manufacturing bricks and tiles; parts of which machinery are applicable to moulding other substances. Sealed 20th April, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND FROM THE 20TH DAY OF MARCH, 1849, TO THE 20TH DAY OF APRIL, 1849, INCLUSIVE.

John Harris, of No. 4, Richard's-terrace, Albion-street, Rotherhithe, in the county of Surrey, engineer, for a mode or modes of founding type, and of casting in metal, plaster, and certain other materials. Sealed 24th March, 1849; six months.

Walter Richards, of Edinburgh, in the kingdom of Scotland, typefounder, for improvements in casting printing types, and other similar raised surfaces, and also in casting quadrats and spaces. Sealed 3d April, 1849; six months.

James H. Staple Wildsmith, of the City-road, experimental chemist, for improvements in the purification of naphtha (called also wood-spirit, or hydrated oxide of methyle), pyroligneous acid, eupion, and certain other products of the destructive distillation of wood, peat, and certain other vegetable matters, and of acetate of lime and shale; and in the purification of coal-tar and mineral naphtha; likewise of spirit being the product of fermentation. Sealed 3d April, 1849; six months.

Stephen White, of Victoria-place, Bury New-road, Manchester, in the county of Lancaster, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of heating, and consuming smoke, also improvements in furnaces for economizing heat, and in apparatus for the consumption of gases. Sealed 19th April, 1849; six months.

PATENTS RECENTLY EXPIRED.

S. Parker, Middlesex, bronzist, for an improved metallic air and water stop and stopper. Patent dated April 14th, 1835; expired April 14th, 1849.

J. Ingledew, Brighton, engineer, for an improved metallic safety-wheel and revolving axis. Patent dated April 14th, 1835; expired April 14th, 1849.

J. Whitworth, Manchester, engineer, for certain improvements in machinery for spinning and doubling cotton, flax, wool, silk, and other fibrous substances. Patent dated April 14th, 1835; expired April 14th, 1849.

H. Booth, Liverpool, gentleman, for compositions or combinations of materials applicable for the greasing of the axle bearings of carriages, and the axles, spindles, and bearing parts of machinery in general, which he denominated "the patent axle grease and lubricating fluid." Patent dated April 14th, 1835; expired April 14th, 1849.

J. Boydel, junior, Chester, Esq,, for improvements in machinery or apparatus for tracking or towing boats or other vessels. Patent dated April 14th, 1835; expired April 14th, 1849.

A. Stocker, Yeovil, gentleman, for improvements in machinery for manufacturing horse-shoes, and certain other articles. Patent dated April 14th, 1835; expired April 14th, 1849.

G. Embrey, Stoke-upon-Trent, potter, for certain improvements in the ornamenting of china, glass, and earthenware. Patent dated April 14th, 1835; expired April 14th, 1849.

Sir J. Byerley, Chelsea, for a composition which will effect a considerable saving in oil and soap used in the woollen manufactories. Patent dated April 22d, 1835; expired April 22d, 1849. (Communication.)

J. M'Curdy, Middlesex, Esq., for an improvement or improvements in generating steam. Patent dated April 22d, 1836; expired April 22d, 1849.

W. Kemp, Burslem, Staffordshire, for a machine for raising sunken vessels. Patent dated April 23d, 1885; expired April 23d, 1849.

R. Earnshaw, Huddersfield, dyer, for a certain improvement or certain improvements in preparing and working wool for making or manufacturing various fabrics. Patent dated April 25th, 1835; expired April 25th, 1849.

M. Strauss-Durckheim has recently presented a memoir to the Academy of Sciences at Paris "On the Analogy between the Muscular Fibre and the Voltaic Pile," the nervous influence being regarded by him as bearing a remarkable resemblance in all its phenomena to the voltaic current. This curious, but involved, subject appears, at length, likely to be brought under the careful examination of competent investigators.

TO CORRESPONDENTS.

"Mr. J. Bell, Thornton."—1. We intend shortly to resume the lectures in question. 2. The simplest of the several processes of preparing artificial or factitious ultramine is that of M. Robiquet, which consists in heating to redness a proper mixture of kaolin (China clay), sulphur, and carbonate of soda. Professor Gmelin, of Tübingen, gives the following process:—Take of sulphur, 2 parts; dry carbonate of soda, 1 part. Mix thoroughly, heat the mixture in a covered crucible to redness, and keep on the fire until the mass fuses. Sprinkle in gradually another mixture of silicate of soda and aluminate of soda (containing 72 parts of silica and 70 parts of alumina), and keep the crucible subsequently on the fire for another hour. The product contains a little free sulphur, which may be readily removed by water.

"Mr. J. R. Fitt, Fakenham, Norfolk."—We think the Royal College of Chemistry (Hanover-square) will answer your purpose. We do not know the terms for a course of study such as you seem desirous to pursue. Apply to the secretary, who will furnish you with all the particulars. Or you might, perhaps, enter into some private arrangement with an operative chemist, or with Mr. Nesbit, of the Kennington school (Kennington-lane). The latter gentleman has a well-appointed laboratory, containing every requisite and convenience for chemical investigations.

"W. J. P."—The Royal College of Chemistry, Hanover-square. To the other questions we will reply next week. The letter which our correspondent alludes to must have miscarried, as we never received it.

"Mr. E. Hollier, Dudley."—Not having seen the apparatus, nor even an engraving of it, we are, of course, unable to give an accurate description of it, and such as would enable our correspondent to construct a similar apparatus. We have, however, applied to the inventor to give us the requisite information. As yet we have received no answer. Perhaps next week we shall be in a position to comply fully with our correspondent's request.

"Mr. Rattlin, Birmingham."—The editors of the *Patent Journal* would be the proper parties to apply to.

"J. T."—Valonia is a kind of acorn, imported from the Levant and the Morea, for the use of tanners, as the husk or cup contains abundance of tannin.

"R. S. M."—Lloyd Bullock, of 22, Conduit-street.

"Mr. Miller, Birmingham."—The analysis of the powder forwarded to us by our correspondent would put us to an expense of about £2.

"T. H."—Factitious kino is prepared as follows:—Take of logwood, 48 pounds; tormentil-root, 16 pounds; madder-root, 12 pounds; water, a sufficiency. Make a decoction; add to this catechu, 16 pounds. Dissolve, strain, and evaporate the strained liquid to dryness. You will obtain about 24 pounds of product.

"R. T."—The alloy formed by fusing together 1 part of zinc, 7 parts of platinum, and 16 parts of copper, constitutes an excellent imitation of gold. This alloy resembles gold of 16 carats fine, and resists the action of nitric acid, unless highly concentrated and boiling.

"Mr. Richard Worthing, Glasgow."—The following is a very good method of preparing sweet balls:—Take of plaster of paris, 4 ounces; sandal-wood, cypress-root, and cloves, of each ½ ounce; gum benzoin and styrax, of each 1 ounce; ivory-black, 2 ounces; musk and civet, of each 1 scruple; ambergris, 10 grains; Peru balsam, ½ ounce; oil of cassia, 10 drops; oil of rhodium, ½ drachm; essence of jasmin, ¼ ounce; essence of neroli, ½ drachm; otto of roses, 15 drops; mucilage made with orange-flower-water, a sufficiency. Mix, and make the mass into beads. Pierce them while soft.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—May 5, 1849.

ORIGINAL SERIES.

ON BENZOLE: ITS NATURE AND UTILITY.

A LECTURE.

By C. B. MANSFIELD, Esq.

[*Continued from page* 348.]

Thus by the manufacturer this symbol of chaos is evolved into a sort of order,—into three distinct portions, pitch, oil, and naphtha, of which, respectively, solidity, liquidity, and volatility are the characteristics; here an ancient alchemist would have recognised three of his elements, earth, water, and air, with his fourth type, the fire, by which he represented all force, present as the indispensable means of separation.

For the next step in the development of this microcosmic creation, which is represented here in this picture of coal-tar (see Table I.), we are indebted to the labours of various chemists at home and abroad, all working together for the great end of subduing the earth. From them we have learned that three sorts of substances exist in the coal-tar; these are arranged by name in the three columns, headed Neutral, Acid, and Basic; here, again, we have a ternary division, which at least rises out of no arbitrary view or accidental property, but from a fact seated very deeply in the nature of things. We find in the inorganic world two distinct classes of bodies which are invested with a peculiar tendency to unite with each other, while all the other substances are free from it. This at once necessitates a threefold arrangement of the subjects of chemistry.

Of the numerous forces of attachment which unite unorganized matter into substances, independently of forms, the most universal, that of which we know most, to which we can most readily oppose at will its appropriate antagonist force (and this, perhaps, is our only road to the comprehension of forces), is that which has been called almost distinctively chemical affinity, that which plays between the sorts of matter called electro-positive and electro-negative, or (though somewhat indefinitely) basic and acid. Substances of these two sorts are found in coal-tar, and are named in the table. To two of these I must, in passing, call your attention (and to one of them more particularly), viz., to carbolic acid and to aniline. The composition of these two bodies is marked on the table just referred to, but I must resort to this other table (see Table II.) to point out a remarkable relation between them and benzole.

They are here represented as being, respectively, the hydrated oxide, and the amide of phenyle, a hypothetical radical, of which benzole is the hydrogen compound. We are not at present acquainted with this compound phenyle in a separate state, apart from these substances; we cannot isolate, handle, and bottle it; but, as will appear from certain considerations which I shall presently bring before you, there are strong reasons for believing that it exists, that it gives coherence, vitality, as it were, to the bodies with which its name and formula, $C_{12}H_5$, are here associated. Carbolic acid was first known in an impure state under the name of creosote, the well-known antiseptic discovered many years ago in wood-tar by Reichenbach, who, not content with presenting us with this notorious stuff, has more recently attracted much notice by some so-called discoveries of his, about certain magnetoid forces, which one part of the community believe to be all stuff too, and another part knew long before he dreamed of them. This substance has since been discovered in coal-tar, and has been shown to be, when pure, a crystalline solid; again, its preparation, by a very simple process, from this beautiful product of vegetal vitality, salicylic acid, has shown us the true nature of its constitution. This mode of transformation, to which I shall have again to call your attention, is represented on this other table (see Table III.);

TABLE I.

SUBSTANCES DISTILLED FROM COAL-TAR.

Therm. Scales. Cent.	Therm. Scales. Fahr.	Neutral.	Basic.	Acid.	
? ? ?	? ? ?	Chrysene = $H_6 C_{12}$? (Yellow Pyrene = $H_6 C_{15}$? powder.) Paranaphthaline = $H_{12} C_{30}$ (Waxlike solid).			Pitch.
300	570	.....	.....	.....	"Dead Oil" (heavier than water).
280	540				
239	462	..... Various Liquid Hydrocarbons.	Leukoline = $NH_8 C_{18}$		
220	430				
212	414	Naphthaline, $H_8 C_{20}$ (Waxlike solid).			
200	390	.....	.....	.....	"Naphtha" (lighter than water).
187	369	.....	.....	Carbolic or phenic acid = $H_6 C_{12} O_2$ (Crystalline solid).	
182	360	.....	Aniline = $N H_7 C_{12}$ (Oily liquid).		
171	340	Cymole = $H_{14} C_{20}$ (Oily liquid).			
148	298	Cumole = $H_{12} C_{18}$			
113	235	Toluole = $H_8 C_{14}$			
111	232	.....	Picoline = $N H_7 C_{12}$		
100	212	(*Water boils*)	.....	.....	
80	176	Benzole = $H_6 C_{12}$ (Spirituous liquid), (Solid at 0° C. = 32° F.)			
70	160	? Alliaceous spirit = H ? C ? S ?			
50	120				
		....	Pyrrol ? (Gaseous ?)		

TABLE II.

Descendents of Phenyle (= $H_5 C_{12}$)

Derived from benzole. In coal-tar.	Benzole (*neutral*) ..... =	$H_6 C_{12}$ =	$H, H_5 C_{12}$ = hydride of phenyle.
	Carbolic *acid* ..... =	$O_2 H_6 C_{12}$ =	$H; O, O, H_5 C_{12}$ = hydrated oxide of phenyle.
	Aniline (*basic*) ..... =	$NH_7 C_{12}$ =	$NH_2, H_5 C_{12}$ = amide of phenyle.
	Nitrobenzole ..... =	=	$NO_4, H_5 C_{12}$ = nitrionide of phenyle.
	Azobenzole ..... =	=	$N, H_5 C_{12}$ = nitride of phenyle.
	Benzonitryle ..... =	$NH_5 C_{14}$ =	$NC_2, H_5 C_{12}$ = cyanide of phenyle.
	Sulphobenzide ..... =	=	$SO_2, H_5 C_{12}$ = oxysulphide of phenyle.
	Sulphobenzolic acid ..... =	$S_2 O_6 H_6 C_{12}$ =	$H; S_2 O_6, H_5 C_{12}$ = hyposulphuric acid coupled with phenyle.
	Benzoic acid ..... =	$O_4 H_6 C_{14}$ =	$H; C_2 O_4, H_5 C_{12}$ = oxalic acid coupled with phenyle.

TABLE III.

From 1 equivalent of		By abstraction of 2 equivalents of carbonic acid,		are formed.	
Cuminic acid	$(H_{12} C_{20} O_4)$	—	$2CO_2$ =	Cumole	$H_{12} C_{18}$
Toluylic "	$(H_8 C_{16} O_4)$	—	$2CO_2$ =	Toluole	$H_8 C_{14}$
Benzoic "	$(H_6 C_{14} O_4)$	—	$2CO_2$ =	Benzole	$H_6 C_{12}$
Salicylic "	$(H_6 C_{14} O_6)$	—	$2CO_2$ =	Carbolic acid	$H_6 C_{12} O_2$

it is one in which the original atom is deprived, by distillation with lime or some other strong base, of two equivalents of carbonic acid.

Of aniline, this remarkable alkaloid, immortalized as it has been by the labours of my kind friend and instructor Dr. Hofmann, and connected as it is by the closest chemical relationship with benzole, I must also speak. But I shall defer for the present what I must particularly point out to you concerning it, contenting myself now with showing you the means by which we detect it in coal-tar. Here is some crude coal-naphtha, and here some solution of chloride of lime, the well-known bleaching liquid. You will observe that this reagent immediately destroys the colour of this solution of indigo. However, on some of it being shaken with the coal-naphtha, we shall observe, when the two liquids separate, that the solution of this inconsistent salt has acquired a deep blue colour, very similar to that of which another portion of it just now deprived the indigo. This property, then, of conferring a blue colour on hypochlorite of lime is characteristic of aniline, and is a sign by which we can always recognise it. This test is the more remarkable as the instances in which we can trust to a mere appearance for informing us of the presence of a compound of carbon, oxygen, hydrogen, and nitrogen, are extremely rare, as may be anticipated from the consideration of the almost infinite combinations into which they enter, which would make it probable that any superficial quality found in any of them would certainly be repeated in some one or more of those most nearly resembling it in proportional composition. The case is very different from that of the chemistry of the metals in which, there being only a small and definite number of bodies under observation, properties peculiar to individuals of them would be likely to occur to us, and would be more easily appropriated when found.

I now come to the remaining column of my table, comprising the neutral ingredients of coal-tar, among which is placed Benzole. These neutral bodies are characterized by the negative attribute, of not being susceptible of either habit of the bipolar attachment, which distinguishes and unites the basic and acid substances. I use the term "attachment" as applied to the mutual relation of acid and alkali in preference to, indeed in negation of, the word "affinity," because it seems to me that the word affinity expressly means a family relationship implying an affection not limited in its scope to one object at a time, but extensible to any number of claimants. Of this latter sort are the ties which unite the family of the hydrocarbons. This sympathy seems to me to be one of those forces, if not the force, which is concerned in the phenomena of ordinary solution. I conceive the tendency of substances to dissolve, or to be dissolved, in each other, without any change in their nature or the formation of a new substance, to be a sort of symbol of family life, and that it is exactly expressed by the term "affinity." Now, the attachment of metal and metalloid, of electro-positive and electro-negative bodies, of base and acid, seems to be so especially a force of dual polarity, intolerant in all the normal cases (perhaps we shall ultimately consider in all cases) of plurality, that I cannot but consider it as the very type of connubial life, not only not affinity, but actually contrary to it,—not directly antagonistic, but a force acting in a direction crosswise to family relationship. This is why I would restrict the word affinity to the sort of love that prevails among the hydrocarbons, using the general term "attachment," for want of a more precise specific appellation, to represent the bipolar adherence of base and acid.

Returning now to our bird's-eye view of coal-tar, and to the column of neutral bodies among which you will see that Benzole is represented as residing, you will observe that in two columns (see Table I.) parallel to that, in which the names and compositions of these neutrals are written vertically over each other, are placed a series of numbers marked on the thermometric scales; these numbers indicate the boiling points of the substances whose names occur on the same horizontal lines. The boiling point is to a volatile liquid what crystalline form is to crystallizable solids—at once the test of purity and the means of attaining it. It is only of late years that the importance of this cardinal property has been fully recognised. We have long been accustomed to associate the No. 212° on the Fahrenheit scale with the boiling of water; we now know that of the immense number of liquids volatile without decomposition, with which modern organic chemistry has made us acquainted, every one is subject in this respect to a numerically expressible law, as definite as that which regulates the behaviour of water under treatment with heat. For every volatile liquid, under every atmospheric pressure, there is a corresponding temperature, above which it never can rise, and beyond which all sensible heat supplied to it is at once converted into expansive vapour-forming force. We select as a standard of comparison the ordinary pressure of the air as measured by the barometer: thus to every volatile liquid a bound has been set which it cannot pass; and nothing can be more striking than to observe all these substances, at all times and places, punctually obeying the law impressed upon them at their formation, and, as soon as the temperature and pressure on their surface reach the co-ordinate points which have been assigned to each of them, assiduously commencing to boil off into vapour. As the boiling point, then, of water is 100° Centigrade, or 212° Fahrenheit, so is that of benzole 80° Centigrade, or 176° Fahrenheit, the same nearly as that which belongs to alcohol. But this law is obeyed exactly only by pure substances; when any volatile liquid is mixed with another it no longer boils constantly at any one point, but the temperature rises gradually through a range intermediate between the points belonging to the two. So in our picture of coal-tar the numbers of the thermometer scales attached to each substance are not the points at which they would actually and solely come over from the retort on the distillation of the tar, but are those at which they would boil and distil if each were alone separately in the vessel. However, if you carry your eyes up the graduated column, and imagine that you are observing the index of a thermometer inserted in a retort, in which tar is being distilled, you will get an approximately correct notion of the order in which the several substances come over, and of the date in temperature at which their appearance is due. In fact, the successive substances do not begin to leave the tar in the retort till a somewhat higher temperature than that which is marked to each, and their distillation will be distributed over a line of rising temperature, through which they are drawn by the affinity which binds them together, and which only yields gradually to the antagonism of the heat; but they come over regularly in the order of their volatility, each, however, being mixed more or less with those which lie nearest to it on the scale of evaporation.

Having now completed my description of the birthplace of benzole, I must speak of its parentage. It is composed, as I have said, of hydrogen and carbon, in the proportion of 8 parts by weight of the former to 92 of the latter element; of 6 atoms of hydrogen and 12 of carbon. Now, the question will naturally present itself to the minds of those who are not intimately acquainted with this substance, "Why call its composition $H_6 C_{12}$, and not $H_1 C_2$, which would agree equally with the result of analysis, and would be simpler?" This leads me a little farther into the history of its formation.

Benzole was discovered in 1825, in this institution, by Mr. Faraday, the connection of whose name with my subject makes me feel the more deeply the honour of being allowed to speak here of a matter which has occupied his attention. Mr. Faraday obtained, from a naphtha produced in the manufacture of gas from oil, a liquid identical in properties with that of which I have to treat as procured from coal-tar. He named it according to the indications of his analysis, "bicarburetted hydrogen." But many years later Mitscherlich, the eminent chemist of Berlin, found that, by distilling benzoic acid with an excess of caustic lime, a colourless volatile oil was obtained, and that carbonate of lime remained in the retort. This oil proved to be the same substance as that of Mr. Faraday. Now, the composition of benzoic acid was known to be $H_6 C_{14} O_4$, and it was found that the carbonic acid thus resulting from its fission saturated twice as much lime as would the benzoic acid which yielded it. And, as shown in this table (see Table III.), by the deduction of 2 equivalents of carbonic acid from 1 of benzoic acid, we get a remainder of $H_6 C_{12}$. These numbers, then, were taken as expressing the true constitution of this oil, which thence acquired the name of "Benzole"; and subsequent experiments, to which I shall have occasion to call your attention, have confirmed the truth of this assumption. This, then, is why we write benzole $H_6 C_{12}$, and not $H_1 C_2$. Exactly analogous considerations lead to the formula representing the brethren of benzole—the hydrocarbons which lie immediately above it on the table of coal-tar. Each of these oils is known to be derived from other sources. Cymole occurs in nature in the oil of cumin seed; toluole is obtained by distillation from tolu balsam; and cumole as well as toluole may be produced by the distillation of organic acids, the cuminic and toluylic, under conditions exactly similar to those under which benzole springs from the ashes of benzoic acid, and carbolic acid from salicylic acid (see Table III.).

Before quitting the tribe of hydrocarbons, I must point out to you that all of those liquid neutral oils of coal-tar, whose composition is yet known are, connected together by the closest bond of fraternity. They are members of a series, as indicated on Table IV., each member of which differs from that next above it, by the increment of two atoms of hydrogen and two of carbon in its composition; and, indeed, they are all successive members of the series, except that there is one gap between toluole and cumole, and it is not certain that that may not yet be filled up from the tar. Not only is their resemblance great in chemical composition, but also in properties; by treatment with various reagents they all go through corresponding metamorphoses, and become converted into compounds strictly homologous with each other.

Table IV.

Tribe of Hydrocarbons ($H_m C_{m'}$)

Instances in Coal-tar.

Members of series of general formula $C_6 + n(H_2C_2)$

Benzole = $H_6 C_{12} = C_6 + 3(H_2 C_2)$

Toluole = $H_8 C_{14} = C_6 + 4(H_2 C_2)$

(Unknown ——— $C_6 + 5(H_2 C_2)$)

Cumole = $H_{12} C_{18} = C_6 + 6(H_2 C_2)$

Cymole = $H_{14} C_{20} = C_6 + 7(H_2 C_2)$

Members of other Groups.

Marsh gas, $H_2 C$; Olefiant gas, $H_4 C_4$;

Naphthaline = $H_8 C_{20}$.

At the bottom of this table have been added the composition of some other hydrocarbons, which also result from the igneous decomposition of coal; they are there placed as instances of hydrocarbons which belong to other series not expressible by the general formula which includes benzole, and the other liquids just alluded to. I may remind you here of the immense extent of the family of hydrocarbons, and of the great variety of properties which are localized by the union of hydrogen and carbon. The three states of matter, solid, liquid, and fluid, are all represented at common temperatures by members of this family. Here are naphthaline and paranaphthaline, waxlike substances from coal-tar, and paraffine, a similar solid from wood-tar; the chief constituents of common coal-gas, aëriform fluids; and not only these naphthas of

which I have just spoken, but many other oils, are liquid hydrocarbons: among them the well-known perfumes—the oils of cedrat, of lemons, and of orange-flowers. The name of naphtha reminds you, perhaps, of olfactory sensations of a less agreeable character. I must beg you, however, to lay aside this prejudice. I believe there is not an hydrocarbon known which has a disagreeable odour; indeed all those that have any odour at all are decidedly fragrant. The ill savour of all those naphthas which are offensive to us arises from compounds containing either nitrogen or sulphur, or, perhaps, phosphorus. One especial business, indeed, of sulphur in organic chemistry seems to be, quite devoid of smell as it is itself, and of so innocent a complexion, to form fetid compounds with hydrogen and carbon. I believe that the ill odour of coal-naphtha is almost entirely owing to the presence in the coal of sulphur, which in the decomposition of that substance enters into combination with the other elements, assumes volatility with the oils which are so formed, and confers on them in exchange a nauseous smell. The essential oils of garlic, of mustard, and of asafœtida, which are well known either for their ill odour or acrid taste, contain sulphur; and the characters of bisulphide of carbon and sulphide of hydrogen—their suffocating, poisonous smell—are notorious. I think it necessary to make these remarks in defence of my friends, the empyreumatic hydrocarbons, from the charge of nastiness. If the hydrocarbons which I have here are not purely fragrant, it is owing to their not being perfectly freed from some other compounds which do not belong to their immediate family circle. There is, however, one among these volatile oils of coal-tar which has a decidedly unpleasant garlic-like odour. It is the most volatile liquid in the naphtha; it is marked on the table (see Table I.) "Alliaceous Spirit"—its composition is as yet unknown, but it is certainly possessed of sulphur. There is, fortunately, but a very small quantity in the tar of this evil body—not above an ounce of it, perhaps, in ten gallons of the tar, which may yield a pint or more of good benzole.

It will be evident, on a mere glance at the table, that by far the largest number of substances in coal-tar are the neutral hydrocarbons; and not only in number of names, but in actual quantity of matter, they infinitely exceed the products gifted with the capacity for binary attachment; indeed, the tar may be said to consist chiefly of them. And they resemble the workers in a beehive, not only in their numbers and their celibacy, but in their practical usefulness. Of coal-tar it is the host of hydrocarbons almost exclusively that have yet been applied to any purpose of economical utility; I take this as a hint that this is not a world to be idle in. And this working population of the tar-barrels, volatile and inflammable as they are in disposition, have this farther claim on our sympathy, that when carefully educated—purified—they are notably bland and mild in their behaviour, while the oligarchy of their basic and acid compatriots are intolerably acrid, the source of almost all the unpleasant qualities of the tar. Carbolic acid will destroy the cuticle of your hand if it touches it, and will act as a violent poison on your tongue; even when dilute it will kill small animals; and so virulent is aniline that a few grains of it will destroy the vital powers of a rabbit—two or three pounds of good animation. Yet so harmless are the hydrocarbons that sailors will sometimes drink a glass of coal-naphtha as a substitute for fine cordial gin; but of course their throats must have been previously casehardened by alcohol, to enable them to resist the effects of the traces of poisonous substances which remain mixed with the neutral oil. So mild, indeed, are the hydrocarbons that any suffering person who prefers the use of anæsthetic drugs to the natural use of the human hand for inducing balmy sleep may flee from pain into the depths of unconsciousness, by inhaling the vapour of that one of them which is sufficiently volatile for the purpose—Benzole.*

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LV.

(LECTURE LXXXIII.)

SAPONIN—(*Continued*).

SARSAPARELLA—(*Continued*).

SECTION II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON THE ROOT—(*Continued*).

PTISAN OF SARSAPARELLA.

Take of Sarsaparella, 60 to 80 grammes.
Boiling water, 1,000 grammes.

Slice the root, bruise the slices, pour the boiling water over them, and keep infusing for four or five hours.

Or, if you have the root in a state of extreme comminution (in mossy shreds), pour lukewarm water over it, and strain after two or three hours. In summer more particularly, prolonged contact of the root with the water should be carefully avoided, as the product otherwise would contain a large proportion of starch, which would speedily produce fermentation.

M. Béral gives the following formula:—

Take of Alcoholic extract of sarsaparella, 4 grammes.
Water, 500 grammes.

Dissolve the extract in the water, and filter the solution.

Four grammes of the alcoholic extract are equal to thirty grammes of the root.

M. Béral's ptisan has a more acrid and disagreeable taste than the infusion of the root.

SUDORIFIC PTISAN.

Take of Rasped guaiacum-root, 64 grammes.
Root of sarsaparella, 32 grammes.
" sassafras, 8 grammes.
" liquorice, 12 grammes.
Water, a sufficiency.

Boil the guaiacum and the sarsaparella for one hour in a quantity of water sufficient to leave about two pounds of product. Add the sassafras and the liquorice, and let the mixture infuse; strain. Let the strained liquid stand at rest for some time, to permit the subsidence of the solid mechanically-suspended particles, and decant the clear liquid off the deposit.

Some practitioners prefer to boil the guaiacum by itself, and to add the sarsaparella subsequently, together with the sassafras and the liquorice. The product is more sapid, but, perhaps, too much so for the great majority of invalids.

SUDORIFIC AND LAXATIVE PTISAN.

Take of The fresh-prepared sudorific ptisan, 500 grammes.
Senna, 16 grammes.

Let the senna infuse in the liquid.

This ptisan is frequently given in painters' colic.

FELTZ' PTISAN.

Take of Sarsaparella, 64 grammes.
Isinglass, 10 grammes.

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* In this application, probably, the gentle spirit protects the blood in the lungs from oxidation by the air; and venous blood circulating through the brain extinguishes the passions of the flesh, just as "laughing gas," opposite in composition and polar in properties, giving the destroyer oxygen in a condensed form to the greedy blood, yields to the nervous centres a more rich arterial fluid, which stimulates to activity the more excitable propensities of the brain.

Take of Sulphuret of antimony, in powder, 80 grammes.
Water, 2,000 grammes.

Boil the sulphuret of antimony for half an hour in a quantity of water; collect the sulphuret of antimony on a filter, and throw the liquid away. Tie the sulphuret up in a bag, and suspend this in the 2,000 grammes of water. Put the incised root, together with the isinglass, into the water, and boil over a small fire, until the liquid has lost about two pounds by evaporation. Feltz used to boil the mixture in an earthen pot, and the operation lasted with him usually six hours.

The chemical effect which the sulphuret of antimony may have in this preparation has not been sufficiently studied, in my opinion. If the sulphuret of antimony happens, as is frequently the case, to contain an admixture of sulphuret of arsenic, this latter substance, according to Guibourt, decomposes the water, disengages sulphuretted hydrogen, and leaves arsenious acid in the liquid. The quantity of arsenious acid thus introduced into the product varies greatly, but is, in most instances, exceedingly minute, since, in the first place, the sulphuret of antimony does not invariably contain sulphuret of arsenic in admixture, and in most instances, when this substance happens to be found in sulphuret of antimony, it is in very minute fractions only; and, in the second place, the water operating simply on the surface of the substance in the bag, a small portion only of the sulphuret is affected by its action. I had reason to suspect, however, that this was not the only effect produced by the sulphuret of antimony. M. Grassi's recent experiments have fully confirmed my suspicions on this point, proving, as they do, that the presence and influence of the salts in the root lead to the solution of a certain quantity of the antimonial parts.

SYRUP OF SARSAPARELLA.

Take of Sarsaparella, 3 parts.
Sugar, 8 parts.

Slice the root, cut the slices into small pieces, and bruise the latter in an iron mortar. Place the bruised mass, with twenty-four parts of pure water, in the water-bath of an alembic, and maintain the bath at the boiling point for six hours. Strain through thin linen. Repeat the same operation twice more. Let the whole of the liquid product stand at rest to permit the subsidence of the solid mechanically-suspended particles; decant the clear liquid off the deposit, and evaporate the decanted fluid until there remain only from eight to ten parts of it. Let the liquid now cool, decant again, and strain finally through a woollen swanskin. Dissolve the sugar in the strained fluid, and boil the solution to 25 Cent. of the areometer. At this juncture, *i.e.*, when the syrup is boiled to 25 Cent., add the whites of four eggs, beaten up in two quarts of water. Let the mixture boil up, and strain the syrup through a common straining-cloth. Replace the syrup on the fire, and boil until the liquid marks 31° boiling.

This process is M. Guibourt's. The preliminary operation of digestion is necessary here, to obtain the largest amount of the soluble principles of the root with the least possible quantity of water. The clarification of the syrup, previous to the final coction, is equally necessary to make the syrup pass freely through the straining-bag; for the large amount of salsaparin which the syrup contains imparts to it a degree of viscosity which would render its filtration in a more concentrated state a task of considerable difficulty.

The syrup of the Codex is prepared with the alcoholic extract. The formula will be found under Section III.

COMPOUND SYRUP OF SARSAPARELLA.

Take of Sarsaparella, 16 grammes.
Flowers of borage,
White roses,
Senna leaves,
Aniseed, of each 1 gramme.
White honey,
Sugar, of each 16 grammes.

Digest the sarsaparella three successive times

in 8 quarts of water, conducting the operation the same way as in the preparation of the simple syrup of sarsaparella. Heat the second and third liquors to boiling, and let the other ingredients infuse in them. Strain, and add the first liquor to the strained infusion; let the whole stand at rest for some time, to permit the subsidence of the solid mechanically-suspended particles; decant, and strain through a woollen cloth. Concentrate the liquid by evaporation, and dissolve in it the sugar and the honey. Boil the syrup to 25 Cent.° of the areometer, and clarify with the whites of eggs, in the same way as in the preparation of the simple syrup. Strain, and boil the strained syrup until it marks 32° boiling.

LARREY'S DEPURATIVE SYRUP.

According to the authentic formula given by Larrey to M. Vuaflard, Larrey's formula differs from that of Cuisinier simply in this, that the honey is replaced by an equal weight of sugar, and inspissated elder juice added to the extent of about the sixtieth part of the weight of the sugar.

To this syrup Larrey added, in some instances, per every two pounds and a half of syrup:—

Perchloride of mercury,
Sal ammoniac,
Extract of opium, of each 50 centigrammes.
Hoffman's drops, 4 grammes.

SECTION III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON THE ROOT.

Alcohol of 56 Cent. extracts the whole of the active principle of sarsaparella. The salsaparin, which certainly contributes considerably to the medicinal action of the root, is readily soluble in alcohol.

ALCOHOLIC TINCTURE OF SARSAPARELLA.

Take of Sarsaparella (properly comminuted), 1 part.
Alcohol of 56 C. (21° Cartier), 5 parts.

Let the root maccrate in the alcohol for fifteen days; strain, with strong expression; filter.

EXTRACT OF SARSAPARELLA.

Take of Sarsaparella (properly comminuted), 1 part.
Alcohol of 56 C. (21° Cartier), a sufficiency.

Moisten the root with one half its weight of alcohol; pile it in the lixiviation apparatus, and lixiviate with 3 parts of alcohol. Displace most of the last portions of the alcohol by water, and distil the alcoholic liquors. Evaporate the residue of the distillation to the consistence of an extract.

This is the formula of the Codex.

Since all the active principles of the root are soluble in a comparatively small proportion of alcohol, there can be no doubt but that the use of this menstruum is preferable to that of water. Moreover, the evaporation of the alcoholic liquors takes much less time than that of the aqueous liquors. The alcoholic extract is accordingly superior in every respect to that obtained by the action of water upon the root.

Eight parts of the root give one part of alcoholic extract.

SYRUP OF SARSAPARELLA.

Take of Alcoholic extract of sarsaparella, 1 part.
Water, 10 parts.
Sugar, 20 parts.

Dissolve the extract in water, at the heat of the water-bath; filter the boiling liquor, add the sugar, and form a syrup by simple solution.

This formula, which has been adopted by the Codex, was first proposed by M. Béral. It is much more sapid and active than the common syrup (prepared with water). I have convinced myself that the whole of the salsaparin contained in the alcoholic extract is dissolved by the water at the heat of the water-bath, and that only a trifling quantity of oily and resinous matter remains undissolved. The solution of 1 part of the extract in 10 parts of water deposits, at the end of twenty-four hours, some salsaparin; but this deposit is not formed in the syrup. (M. Guibourt states, however, that the syrup of sarsaparella prepared with the alcoholic extract deposits salsaparin in the course of time.)

Twenty-five grammes of this syrup contain one gramme of extract, corresponding to eight grammes of the root.

WINE OF SARSAPARELLA.

Take of Spanish wine, 15 parts.
Alcoholic extract of sarsaparella, 1 part.

Dissolve, and filter the solution.—(Béral.)

Thirty grammes of this represent sixteen grammes of the root.

PORTABLE PTISAN.

Take of Alcoholic extract of sarsaparella, 1 part.
Good wine, 3 parts.

Dissolve, and filter the solution.

One part of this wine represents two parts of the root.—(Béral.)

Ptisan of sarsaparella may be made extemporaneously by diluting this preparation with the requisite quantity of water.

CONCENTRATED ESSENCE OF SARSAPARELLA.

Take of Sarsaparella, 4 parts.
Liquorice,
Guaiacum,
Sassafras, of each, 1 part,
Alcohol of 56 C. (21° Cartier), 64 parts.

Make an extract.

The weight of this extract is usually about 1 part.

To prepare the concentrated essence,

Take of This extract, 8 grammes.
Good wine, 55 grammes.
Essence of sassafras, 1 drop.

Dissolve, and filter the solution.—(Béral.)

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE EMPLOYMENT OF THE REFUSE OF THE PAPER MANUFACTURERS AS MANURE.

By THORNTON J. HERAPATH, Esq., of Bristol.

The object of the present paper is to call the attention of those engaged in agricultural pursuits to the valuable fertilizing properties possessed by the waste products of some of our paper manufactories. In 1843 a patent was granted to Mr. Lemuel Wellmann Wright, engineer, of Wrexham, North Wales, for "certain improvements in machinery or apparatus for bleaching certain fibrous substances, and for improvements in machinery or apparatus for manufacturing the same into paper."* These improvements principally consist in acting upon the wheat, barley, oat, pea, or bean straw, or other substances employed, with a moderately strong solution of caustic alkali. This is effected in the following manner:—Numerous consecutive layers of the straw, soda-ash,† and caustic lime are superimposed one upon the other in a large vat or cistern, until the latter is completely filled; and an adequate quantity of water is then added to facilitate the decomposition of the carbonate of soda. The caustic soda produced acts upon the intercellular and incrusting matters of the vegetable fibre, and converts them into substances somewhat analogous to ulmine or ulmic acid, which are dissolved in the excess of alkali. The action having been allowed to continue for a certain time until the straw is completely bleached, the liquid is run off, and the vegetable fibre reduced to a pulp by means of peculiar machinery. This pulp, having been washed, &c., in the usual manner, is then strained upon fine wire-cloth sieves, and converted into paper. The fluid which passed through the interstices of the wire-gauze is then conveyed, together with the alkaline solution, by means of suitable apparatus, to a large tank or reservoir, where it is allowed to remain undisturbed for several days, in order to afford time for the lighter solid particles, which are kept in suspension by the liquid, to deposit; when this has taken place, the supernatant fluid is drawn off by means of a sluice, &c., into another reservoir, where it is kept for use, or whence it is pumped into casks for sale. The relative proportions of the solid and liquid substances thus obtained (both of which, as will be hereafter shown, are more or less valuable as manures) differ considerably under different circumstances; but the latter always greatly exceeds the former in quantity. In the manufactory of the Messrs. Wiggins and Co., of Chalford, which produces about fifteen tons of paper weekly, the former does not exceed two tons in weight, whilst the latter often amounts to 10,000 gallons.

At the request of my father, Prof. W. Herapath, I have subjected some specimens of these manures, from the above-mentioned manufactory, to an examination, of which the following are the results.

FLUID MANURE.

It was highly coloured and somewhat mucilaginous; very similar in appearance to treacle and water; specific gravity at 60° F. 1.0112; it evinced an alkaline reaction with test paper, and possessed a somewhat astringent taste. The addition of an acid produced a dense coagulum of ulmine, &c.

An imperial gallon (=70,784 grains) of the fluid contained of—

	Grains.	
Water		69623.680
	Grains.	
Organic matters	729.600	
Carbonate of soda, with a little caustic soda*	332.992	
Silicate of soda	13.440	
Sulphate of soda	19.328	
Phosphate of soda	1.280	
Chloride of sodium	10.560	
Carbonate of potash, Chloride of potassium	a little	
Carbonate of lime	8.320	
Carbonate of magnesia	traces	
Sulphate of lime	traces	
Phosphate of lime	4.480	
Phosphate of magnesia	traces	
Oxide of iron and alumina	8.320	
Silica, &c.	32.000	1160.320
		70784.000

In order to determine the proportion of nitrogen contained in the organic matters, 5 grains of the dried residue were taken and burnt with potash-lime; 1.54 grains of ammonio-chloride of platinum were obtained = 0.0979 grain of nitrogen = 1.9580 per cent. = 2.3760 of ammonia. Consequently a gallon of the fluid contained 30.701 grains N, or 40.279 grains NH_3.

SOLID MANURE.

This was a pulpy, somewhat fibrous, yellowish-grey substance; by drying it was converted into a coherent mass, which was easily reduced to powder. Two different specimens were found to contain per cent. respectively:—

Water	60.991	56.437
Organic matter	4.235	7.864
Carbonate of soda	2.010	1.720
Silicate of soda	traces	traces
Sulphate of soda	0.100	0.227
Phosphate of soda	0.008	0.037
Chloride of sodium	traces	traces
Carbonate of potash, Chloride of potassium	traces	traces
Carbonate of lime	27.761	20.496
Carbonate of magnesia	a little	a little
Sulphate of lime	traces	—
Perphosphate of iron	0.502	0.487

* "Mechanics' Magazine," No. 1051, p. 254.

† Potash, doubtlessly, might be substituted for this with advantage, did not the high price prevent its employment.

* Upon exposure to the air, this was very soon converted into the neutral carbonate.

Oxide of iron and alumina..	1.564	1.498
Silica, &c.	2.829	11.237
	100 000	100.000
Nitrogen	0.09906	0.24800 p. c.
which is equivalent to		
Ammonia	0.12100	0.30100

By long keeping, this manure becomes altered in its nature; it gradually loses its fibrous character, and becomes dark grey and pulverulent.

Remarks upon the above analyses are almost unnecessary. The liquid manure, it will be immediately seen, is by far, comparatively speaking, the richest of the two, not only in the alkaline carbonates, sulphates, and chlorides, but also in the more valuable constituents, the alkaline and earthy phosphates and nitrogen. The best and easiest method of applying it to the land would, in all probability, be by means of the liquid-manure cart, in conjunction with some other manure, such as sulphated bones (superphosphate of lime) or guano. Care should be taken, however, if the latter be used, that no free alkali is present in the liquid, as otherwise a considerable loss of ammonia might occur. This, however, can be always avoided by the addition of a little dilute sulphuric acid. It may be also applied as advantageously, and, perhaps, more economically, by the ordinary mode of irrigation, where the nature of the ground will admit of it.

The solid residuum would form an admirable diluent for more stimulating manures. Dried, and intimately mixed with guano and sulphated bones, it would increase their fertilizing power by the addition of about five per cent. of alkaline salts, and, at the same time, prevent their exerting too energetic an action on the young and tender plant.

The silicate of soda, and finely divided silica, again, which these manures contain, also render them peculiarly adapted for the cultivation of the cereal plants and graminaceæ generally, by furnishing them with materials from which to form the hard siliceous cuticle which it is so necessary for them to possess, in order to enable them to support the grain.

The solid manure would, also, without doubt, prove of service to the florist in the preparation of the composts for his choice flowers. The Messrs. Wiggins have long employed it for this purpose in their own garden, which is now considered to produce the finest shrubs and flowers of any in the neighbourhood.

ON THE PROBABLE CAUSE OF EARTHQUAKES IN DOMINICA, AND ON OTHER MATTERS HAVING REFERENCE TO THAT COLONY.*

By WM. DRUMM, Esq., of Broad-street, Barbados.

The following observations, made during my recent visit to the island of Dominica, on the probable cause of the earthquakes which are of such frequent occurrence in that island, may not prove uninteresting to the readers of the *Chemical Times*:—

On jumping ashore from the canoe that landed us from the vessel at Roseau I was struck with the firmness and dark colour of the beach sand, and noticed it for future observation. Having expressed a desire to see the interior of the country, my old and well-esteemed fellow-countryman and friend "B." offered to be my companion and guide, and several gentlemen in the kindest manner offered me the use of their horses. Our first journey was to the lake, about three hours' ride from the town, situated high in the highest mountains of the island, with the clouds rolling past on the trees and hills around, but often resting far below its level waters, without any visible source or spring, and with no known outlet: its clear and calm waters (the ruffling of which by even a pebble stone will attract the passing cloud of rain) resting so silent, so lonely, and so high amidst the wildest range of nature's works, it offers something solemn to the mind of every observer, and places inquiries before every seeker after knowledge. Such a body of water so high! and this lake being only one of many such in these immediate islands. Whence their cause? And what is the rule that sustains water in such bulk at or above the highest level? The road to this lake is nearly through the centre of the island, and presents to the eye many scenes of the grandest beauty—the Roseau-valley, the waterfall, the pile of hill and hill and mountain side, tropical plants and trees in luxuriance and magnitude, which only nature's freedom can produce, the different land and soils, as the stony, the sandy, and the red earth, the chalky soil, the blue clay, and the rich black mould, all of which we pass in every variety during the ascent to the lake; and, passing it, a short walk along the road opens to the view the other or windward side of the island, and in the distance far below can be seen the cultivated fields and the buildings on the estates; and on the broad Atlantic spread before you may be seen Maria Galante, and perhaps a vessel passing between the islands or homeward bound. We had most fortunately a dry day for our journey, and I should pity any man who had to ride that journey during rainy weather; for then the slippery parts of the road, especially those on the mountain ridges, would require the greatest caution, and the cold, chilling breeze that blows on the mountain tops making the feet, and hands, and face tingle like a frosty morning in winter at home, with rain, would be quite unbearable, at least to a Creole or to any European acclimatized to the West Indies. Noticing during our journey the different strata and frequent appearance of iron stone and clay, I observed to my friend what I had previously noticed of the beach sand; and shortly after our return he obtained a sample of it, which confirmed my suspicion that it was metallic; but not as I expected a compound of iron, but iron in a nearly pure state, only minutely divided. A sample of the sand was laid on paper, a weak magnet was dipped in it, and the magnet was instantly covered with the iron. On dissolving some of it in acid and applying the proper chemical tests the presence of the metal was proved beyond dispute. This metallic or iron sand is not only found on the beach at Roseau, but it encompasses all the island as far as I can see; and in different places, as at the mouths of the rivers, it is found much purer, and without any admixture of common sand. Now, if equal quantities, say 50lbs. of sulphur and 50lbs. of iron filings, be mixed together, and the mixture be wetted with water and buried underground, in an hour or two an artificial volcano will be produced, the earth will be thrown up, and the compound will burn with great heat and intensity. Having satisfied myself that the sand of Dominica was chiefly iron (brought down to the seashore, as I think, by the rivers, and kept there by its great weight, it answers a wise and designed purpose, as its density and compactness is an almost effectual barrier to the heavy surf that beats that coast, while a beach of common siliceous sand, or of broken shells and sand, as the Barbados beach, would be swept away by the unceasing surf, and the land be continually encroached on), and having previously visited the sulphur beds and the hills on the Soufrière estate, and hearing that sulphur was found, and also the same sand, in different parts of the country, I stated in my next lecture the above means of producing an artificial volcano; and my opinion that something similar was the cause of all the earthquakes then occurring, and that these concussions of nature were simply the result of *chemical action*. Producing the sand, it was shown to be iron; and the action was described which would take place if a bed or mass of this iron-sand and a bed of sulphur came together, or were naturally in contact. While dry there would be no action, but on becoming wet with water intense chemical action would take place. Heat and fire would be produced, part of the water would be decomposed to form new compounds with the iron, and the other part of the water acted on by the heat would be made into steam, which, expanding to 1,800 times its bulk, would force a passage for itself with a power proportionate to its quantity. The influence and connection of sulphur with the earthquakes were shown by its frequent smell or vapour in the atmosphere, and by the water in all the Roseau wells being sulphurous after some of the severe shocks. I said then that it was probable that the earthquakes were caused by the expansive power of the steam which would be produced by the burning soufrières, or by the chemical action of the sulphur and iron-sand, as the steam so produced must find passage either in the open air or by forcing its way into the sea, or into some of the subterranean water-courses; and this opinion of the probable cause of earthquakes was afterwards greatly strengthened, if not fully confirmed, by the following circumstances, viz.:—Accurate observation of the earthquakes, for, after experiencing several in the hurry of the day, and in the midst of noise and bustle, I was one night writing, and about ten minutes before one o'clock the calm stillness of the night was suddenly broken by a loud hissing or rushing, as if an enormous steam-valve was then opened, and on the instant the house was shaken, and there were three distinct vibrations or concussions, and then a noise as if water had fallen down or was rushing rapidly over large pebble stones, and all was quiet again; and such was the experience of other persons, and of all the earthquakes that were noticed during my stay; and this was also confirmed by a subsequent visit to the so-called Soufrière, on the Wotton Waven estate, about three or four miles from Roseau town. We rode there one evening, and, from its name and the general description I had heard of it, I expected to find a sulphur bed or hill on fire, or undergoing slow combustion. Long before we reached the place the white vapour was visible and it appeared almost similar to the smoke of burning sulphur—but no, on coming close to one of the outlets this vapour was found to be the vapour of boiling water—*steam*, hot, noisy, dangerous, and powerful steam, and in no small quantity; we rode close to the place and stopped at the side of a small stream of water about six feet across; on the opposite side was a hill at least one hundred feet high; the road led up its sides, but at its base, and nearly opposite to where we halted, not more than twelve feet distant from where we stood, and about one foot above the level of the stream, was a small irregular opening scarcely large enough to admit a man's hat, through which, however, steam was pouring out in regular blasts, while the heavings and throbbings inside were plainly audible; we passed up the stream; the hillside was all steaming, several parts smelling of burning sulphur; numerous streams of boiling water and scents of sulphuretted hydrogen gas, then red and black streams running out of the hill, and then a hot spring of water fully impregnated with iron, more so than any spa water I had ever tasted; beyond this we could see no further trace of action; passing down, we counted the large mouths, or, as I called them, "*the safety steam-valves*;" there were five extensive ones, and one—the lowest down—was an enormous one discharging steam that rose at least 120 feet in the air, and the throes of which it was very alarming to hear: any one of the valves was discharging sufficient steam to work the largest steamer or engine. Returning, I got across and as close as possible to the first: while trying to get some of the crystals forming on the side of the hill I noticed the noise increasing; the steam was checked, my friend called on me to get back, the noise increased; another and another heave, and out poured a perfect torrent of boiling water, in the vapour of which I was nearly enveloped; we then crossed the river, rode up the hill, and along its top. Here was

* Communicated by the author.

the most luxuriant vegetation. We alighted on a level spot just cleared by burning for the planting of provisions; close beside us there was a large circular hole at five feet across, but narrowing down to a point about five or six feet below the surface, where the thick blue mud was boiling and spluttering away; and this had recently been in more violent action still, as the trees all around were spotted, and the leaves burnt by the boiling mud; close beside it was another hole in which the mud was more fluid, and the hole full; it was rapidly boiling; a little stream was passing down close by and forming many little level spots of clear water which were kept furiously boiling, so that we durst not approach them. I broke off a young pineapple and threw it in the boiling pond, but it stuck. I then lifted a stone to throw it in, but dropped it quickly enough, it proving far too hot for my fingers to hold; and now standing on the top of this hill close to these boiling pools of mud and water, and remembering that at the base, about one hundred feet below, those open mouths were discharging such quantities of steam, we considered it was dangerous quarters, and, turning to my friend, I asked him, suppose it possible that, while we are here, the different mouths or valves below us were instantly and effectually closed so as to confine the steam, where then would we and this hill be in the following moment? And what effect would such an explosion as must then occur produce in the whole island? And such may occur, for the valves are not more than one foot above the level of the stream of water, and the rise of that stream after rain might stop them, and from this cause or any other stoppage the steam would have to force a fresh passage, and in doing this would cause concussions or shakings of the earth around. I left this place with very different notions of Dominica from those which I had formerly entertained. From all I had heard or read of the island, these steam-valves and the boiling springs above are considered as mere soufrières or sulphur beds; their real nature and the different matters connected with the place, the springs of hot sulphur and iron water, the hot chalybeate spa and the sulphuretted hydrogen water, are unknown, though these explain so much of the matter, and might be used with great success as medical agents. This unseen but stupendous furnace and cauldron, where more water is boiled by nature that man can ever attempt to equal, and unceasing action of which is perhaps the most easily observed and the least difficult of access in the world, is merely *known*, but neither *noticed* nor *considered* by any. We found but little difficulty in getting close to each of the mouths, although forbidden by our guide, and then, on finding it necessary to leave, it was with regret we turned away with so little knowledge of so wonderful a place; perhaps, however, these matters may be quite as well known to others, but, even if so, I must be excused for their publication, as it was requested of me, and I could not refuse it, as possibly it may induce others to follow up observations, and collect facts and materials for the full satisfaction of future inquirers or visitors, or possibly this notice may induce one or more of my friends to pursue investigations with a view to personal benefit or the advantages of the colony itself. Suppose, for instance, in the working of sulphur beds—suppose, as certainly will be done, the finding of an iron mine or several mines of which the ore will be found to be nearly pure iron—suppose the obtaining of iron from the beach sand, which could be done with certain ease and profit, as the iron in the sand is almost pure, and the whole country is covered with wood, the use of which in smelting iron improves its quality, and would permit its refining or conversion into the best steel for almost a trifle in comparison with the outlay in other countries—suppose that the manufacture of bricks, tiles, or pottery, or ware may be hereafter tried, there is the best earth, fine sand, and water, and plenty of fuel and room, for the purpose. Suppose I am correct as to the cause of the great action or combustion going on at Wotton Waven, namely, chemical combination, and, supposing some person, having the right and means and the will for such things, tried, by the stoppage of the streams that run over and through that hill of sulphur and iron beds, to leave them dry, and, gradually exposing them to the atmosphere, made them harmless to the country and beneficial to himself, by obtaining the minerals for his profit; or, if even none of these results should occur, these observations may induce others to make correct observations of the works of nature, and then, by seeking explanations of them at the hands of science, they may be enabled to see the development of laws invariably the same—the operation of causes and the influence of matter unceasingly occurring, which we know, but cannot explain—which we can produce and observe, but which fully to comprehend is beyond our mental powers, and which must impress on all the indisputable evidences of superior skill and mind, and the boundless power and influence of that Being that rules and directs all.

Stating the existence of iron in Dominica sand to a friend, he has kindly given me a sample from Antigua, and states that the sand is the same in Martinique, St. Vincent, St. Lucia, Guadaloupe, and many of the other islands where there are also sulphur beds and mountain lakes, and to which islands the usual range of West India earthquakes is confined. I may not close this article without paying a due tribute to a noble man (but, alas! it is only possible to do so to his memory) whose intellect seemed to comprehend the resources, and whose inclination and will it was to develop the unknown and unopened sources of wealth in Dominica. To the name of "Laidlaw" is due some lasting tribute for the energy he displayed, and the great exertions he, almost alone and unsupported, made to open up the country and advance its general interests. Such men are scarce; such patriotism is rare; and can we wonder that it is so when such men as he die almost unhonoured, when his name is scarcely ever mentioned, when his outlay is lost and unrepaid, and his family suffering,—and why? For his patriotism, his generosity, and his confidence. Who, then, will follow his example?

ON THE ISOMERIC MODIFICATIONS OF PHOSPHORIC ACID.

By H. ROSE,

Professor of Chemistry in the University of Berlin.

[*Concluded from page* 354.]

b-Phosphoric Acid (*Pyrophosphoric Acid*).

At least two sub-modifications of this modification of phosphoric acid must also be admitted; for there are two different kinds of pyrophosphates. One of these consists of the well-known pyrophosphate of soda, which is obtained by heating the *c*-phosphate of soda, $2NaO, P_2O_5, HO$, to redness, and the salts which are formed from this soda salt by decomposition. The second variety is produced in the same manner as Maddrell's insoluble metaphosphates, that is, by heating the salts with excess of phosphoric acid, the heat not being so great as to cause the production of metaphosphates. Thus, by treating nitrate of copper with phosphoric acid, a salt of copper is formed which resembles the insoluble metaphosphate of copper, especially as regards insolubility. But the acid existing in it may be readily isolated by a current of sulphuretted hydrogen, and its aqueous solution possesses the same properties as the solution of ordinary pyrophosphoric acid. As this modification of the pyrophosphates has not been sufficiently examined, a more detailed notice of it cannot now be given.

As is well known, the pyrophosphates are formed when the *c*-phosphates, which contain two atoms of a fixed and one atom of a volatile base (oxide of ammonium or water), are heated to redness. The usual process is the conversion of the ordinary phosphate of soda ($2NaO, P_2O_5, HO$) into pyrophosphate of soda ($2NaO, P_2O_5$).

Graham ascribes the difference in the properties of the pyrophosphates from the phosphates to the difference in the capacity of saturation of the two acids contained in the two kinds of salts. It cannot be denied that pyrophosphoric acid especially saturates two atoms of a base, and thus differs characteristically from the *c*-phosphoric acid, which requires three for its saturation. But I have remarked above that this is a consequence of the isomerism of the two acids; hence it must appear as not improbable that an atom of water may be expelled from the ordinary phosphate of soda without converting it into a pyrophosphate.

Some experiments which were made with this point in view have not, however, yielded a favourable result. The ordinary phosphate of soda was exposed to a very gentle heat, so that it still contained more than one atom of water; 3.0635 grms. of it, when heated to redness, gave 2.7900 grms. of pyrophosphate of soda. This phosphate of soda, therefore, still contained 0.2735 grm., or 8.92 per cent., of water. 3.126 grms. of the same salt were exposed for a considerable time to definite temperatures; it was found that, by gradually heating the salt, almost the whole of the water it contained could be expelled at a temperature of 464° F. The following are the details of this experiment:—

The above quantity of the salt weighed after exposure to a heat of—

320°	F. during	11	hours	3.054	grms.
320	"	6	"	3.053	"
320	"	8	"	3.043	"
446	"	4	"	3.015	"
446	"	6	"	2.967	"
464	"	2	"	2.920	"
464	"	2	"	2.894	"
464	"	2	"	2.887	"
464	"	2	"	2.883	"

Had the salt been kept for a still longer time at a temperature of 464° F., it would, undoubtedly, have lost the whole of the water it contained. The quantity used would then have weighed 2.846 grms.

But, when the salt was examined, it was found that, even at the above temperature, it had become almost completely converted into pyrophosphate of soda. The solution gave a white precipitate with nitrate of silver, which was mixed with as much of a yellow one as would have been expected from the quantity of water still existing in the heated salt.

Solution of pyrophosphate of soda yields, with very many neutral salts of metallic oxides, precipitates which are partly soluble in excess of the pyrophosphate of soda. The peculiarity of the pyrophosphate of soda in readily forming double salts has already been very distinctly pointed out by Stromeyer. Persoz has recently studied this point without alluding to Stromeyer's memoir; he has, however, confirmed all the facts given by him. Schwarzenberg has recently examined most of the pyrophosphates quantitatively; and Baer has made the interesting discovery that those insoluble precipitates, which are produced by a solution of pyrophosphate of soda, and are not soluble in excess of it, are frequently insoluble double salts of the soda salt with the pyrophosphates formed, in which the soda replaced the other base, apparently without the two existing in the double salt in a definite simple proportion. Even the silver salt contains some, although a small quantity of, soda. Persoz and Fleitmann have also procured and examined insoluble double salts of the pyrophosphate of soda with the pyrophosphate of copper.

The following are the special reactions of a solution of pyrophosphate of soda with salts of the metallic oxides:—

Solution of chloride of barium produces a precipitate which is insoluble in excess of the soda salt; at least the filtered liquid either yields no precipitate, or at most a very slight troubling, with dilute sulphuric acid.

Solution of chloride of calcium produces a precipitate which is soluble in a very large quantity of the pyrophosphate of soda. The clear liquid, however, becomes spontaneously turbid when set

aside, and in twenty-four hours a very slight precipitate only of oxalate of lime is caused by a solution of oxalate of potash.

Solution of sulphate of magnesia produces a precipitate which is soluble in excess of the pyrophosphate of soda; but, on ebullition, a copious precipitate is formed in this solution, which does not disappear as the liquid cools. Ammonia does not cause a precipitate in a solution of the pyrophosphate of magnesia in pyrophosphate of soda, even when set aside for a long time. The precipitate of the pyrophosphate of magnesia is also readily soluble in excess of sulphate of magnesia. Ebullition causes a precipitate in this solution, which does not disappear on cooling.

Solution of nitrate of silver produces the well-known white precipitate. It is not wholly insoluble in a very large excess of the pyrophosphate of soda. The supernatant liquid does not affect litmus-paper, and only renders it blue when excess of the soda salt has been added.

Solution of pernitrate of mercury, although it necessarily contains free nitric acid, produces a copious white precipitate, which becomes basic and of a reddish-yellow colour on the addition of excess of the pyrophosphate of soda.

Solution of the protonitrate of mercury produces a white precipitate, which is soluble in excess of the pyrophosphate of soda. In this solution ammonia causes a blackish-grey, sulphuret of ammonium a black, and hydrochloric acid a white precipitate; the latter consists of chloride of mercury.

Solution of bichloride of mercury does not immediately produce any precipitate. After a considerable time a dense red precipitate is formed, which is still more rapidly thrown down when heat is applied.

Solution of sulphate of copper produces a bluish-white precipitate, which is readily soluble in excess of pyrophosphate of soda. The solution is of a blue colour; on the addition of ammonia it becomes of a darker blue; sulphuret of ammonium immediately produces in it a brown precipitate of sulphuret of copper. The pyrophosphate of copper is also soluble in a very large excess of sulphate of copper. Heat produces a precipitate in the solution which does not disappear on cooling.

Solution of acetate of lead causes a white gelatinous precipitate readily soluble in the pyrophosphate of soda. Sulphuret of lead is immediately thrown down from this solution by sulphuretted hydrogen.

Solution of protosulphate of manganese produces a white precipitate, which is insoluble in excess of the protosalt of manganese, but is soluble in the pyrophosphate of soda. This solution is not troubled by ammonia; sulphuret of ammonium does not produce a precipitate of sulphuret of manganese in it (which certainly deserves special notice), even when set aside for a considerable time.

Solution of protosulphate of iron produces a white precipitate, soluble in excess of the pyrophosphate of soda. A black precipitate of sulphuretof iron is immediately formed in the solution on the addition of sulphuret of ammonium; the solution is not, however, rendered turbid by ammonia; it merely renders it of a dark colour. The pyrophosphate of iron is also soluble in excess of the solution of the protosulphate of iron.

Solution of perchloride of iron causes a white precipitate, readily soluble in excess of the pyrophosphate of soda. Sulphuret of ammonium immediately produces in the almost colourless solution a black precipitate of sulphuret of iron, which deserves particular notice, because Persoz denies the production of sulphuret of iron in the solution by sulphuret of ammonium. Ammonia, however, does not render the solution turbid; it immediately turns it of a blood-red colour.

Solution of sulphate of zinc produces a white precipitate, soluble in the pyrophosphate of soda. The solution is neither precipitated by ammonia nor by boiling, but sulphuret of ammonium throws down sulphuret of zinc. The precipitate is also soluble in excess of the solution of sulphate of zinc. On boiling the solution becomes turbid; the turbidity does not disappear on cooling.

Solution of sulphate of cadmium produces a precipitate which is soluble in pyrophosphate of soda. The solution becomes turbid when heated, the turbidity not disappearing as the solution cools. Sulphuret of cadmium is immediately precipitated from it by sulphuret of ammonium.

In a solution of sulphate of nickel a greenish-white precipitate is produced, which is readily soluble in the soda salt. The solution is not rendered turbid by heat. With chloride of nickel the same reaction occurs, except that the solution of the precipitate in excess of the soda salt is rendered turbid when heated, and does not become clear on cooling. Sulphuret of nickel is immediately thrown down from this solution by sulphuret of ammonium.

Solution of sulphate of cobalt is precipitated of a pale red colour; the precipitate is readily soluble in the soda salt. The solution is red, and, when heated, becomes perfectly blue, but not turbid; on cooling it reacquires the red colour. Sulphuret of ammonium immediately causes the formation of sulphuret of cobalt in it.

Solution of alum produces a white precipitate soluble in the soda salt. No precipitate is caused in this solution either by ammonia or sulphuret of ammonium. But the precipitate is soluble in excess of the solution of alum.

Solution of nitrate of bismuth, although it contains free acid, produces a white precipitate, soluble in the soda salt. On applying heat a precipitate is formed. Sulphuret of ammonium produces sulphuret of bismuth in it.

No precipitate is caused in a dilute filtered solution of albumen by solution of pyrophosphate of soda, even after the addition of acetic acid.

As is well known, aqueous solution of pyrophosphoric acid is best obtained by decomposing the pyrophosphate of lead, suspended in water, by a current of sulphuretted hydrogen. In this manner the conversion of the pyrophosphoric acid into the *c*-phosphoric acid is avoided, which, as we know, ensues after the lapse of some time even by repose, but much more rapidly when the acid is heated. If, however, the solution of pyrophosphoric acid has been saturated or supersaturated by a strong base, it may be kept in it without undergoing any change. Neither by ebullition nor by long repose is the *b*-phosphoric acid converted into the *c*, and a solution of the pyrophosphate of soda may be preserved for many years without change. With excess of alkali the solution of pyrophosphoric acid is not converted into the *c*-phosphoric acid until the mass, after evaporation to dryness, has been completely fused. But even in this case, according to Weber, the entire conversion into the *c*-phosphoric acid does not take place until the pyrophosphate has been completely decomposed by fusion with excess of alkali, especially an alkaline carbonate. As this does not occur completely on fusing pyrophosphate of lime with excess of an alkaline carbonate, the *b*-phosphoric acid of the undecomposed portion of the lime salt does not, therefore, become converted into the *c*-phosphoric acid. With the application of a high temperature, the conversion can be better effected in this manner in the case of the pyrophosphate of strontia, and still better of the pyrophosphate of baryta; pyrophosphate of magnesia may be completely decomposed, and the pyrophosphoric acid contained in it completely converted into *c*-phosphoric acid, even by fusion over a spirit-lamp with a mixture of carbonate of potash and carbonate of soda in atomic proportions.

It is well known that the conversion of pyrophosphoric acid is perfectly effected by acids, especially when it is heated with them. The stronger the acid, the more completely the conversion is effected; it succeeds best when concentrated sulphuric acid is used.

An aqueous solution of pyrophosphoric acid, immediately after its preparation, exhibits the following reactions:—

Solution of chloride of barium produces no precipitate; after a long time a very inconsiderable troubling occurs. A precipitate is produced in the liquid by ammonia.

Solution of chloride of calcium produces no precipitate, even after long repose. Ammonia causes a precipitate, although it is not very copious. Lime-water immediately causes a precipitate, even when the solution is slightly acid; if, however, excess of pyrophosphoric acid is added, the precipitate is redissolved; ammonia does not then cause a precipitate in this solution.

If chloride of ammonium be added to pyrophosphoric acid, and it then be supersaturated with ammonia, solution of sulphate of magnesia produces a precipitate, which is, however, soluble in a very large quantity of water. If a solution of *c*-phosphate of soda be added to this liquid, a precipitate is immediately thrown down.

Solution of nitrate of silver usually causes no precipitate. On saturation with ammonia a white precipitate is produced, which, if the solution of pyrophosphoric acid has stood for some time, is of a yellowish tint. Solution of acetate of silver produces a white precipitate, which is soluble in a large quantity of pyrophosphoric acid.

A dilute filtered solution of albumen causes no precipitate. It is a remarkable fact that even in the last edition of Berzelius's "Lehrbuch" he ascribes to pyrophosphoric acid the property of precipitating albumen, and thus distinguishes it from the *c*-phosphoric acid. Also, according to his statement, solutions of the pyrophosphates after the addition of acetic acid precipitate albumen. It is, however, a very characteristic property of pyrophosphoric acid that it does not precipitate albumen, and by this very property it differs most essentially from metaphosphoric acid, all the sub-modifications of which possess the property of precipitating albumen in a remarkable degree.

I have already remarked above, that the aqueous solution of pyrophosphoric acid obtained from the insoluble pyrophosphate of copper by sulphuretted hydrogen gas exhibits the same reactions as the acid obtained from the lead salt.

Pyrophosphoric acid differs from metaphosphoric acid, in addition to its characteristic reaction with albumen, also in that with a solution of chloride of barium, although, as I have remarked above, all the modifications of metaphosphoric acid are not alike in this respect; also in the different properties of the precipitate produced by a solution of silver, regarding which it must be observed, that one of the modifications of metaphosphoric acid forms a soluble salt with oxide of silver. The difference between the reaction of metaphosphoric acid and pyrophosphoric acid with albumen therefore forms the most important distinction between these two acids.

c-Phosphoric Acid (*ordinary Phosphoric Acid*).

This modification of phosphoric acid is the one most commonly occurring in analytical investigations, because the other modifications are converted into it by the action of acids.

Its salts have been so frequently examined that most of their properties are known. One property, however, which especially characterizes the *c*-phosphates appears to have been hitherto overlooked. This consists in the solubility of a large number of the insoluble phosphates in excess of the saline solution, from which they have been precipitated by means of the phosphate of soda. The solution generally possesses the property of producing a copious precipitate when heat is applied, which disappears, however, on cooling. Hence double salts are formed, which are decomposed by a high temperature. Many of the precipitates thrown down by pyrophosphate of soda frequently dissolve, as has already been mentioned, even in

excess of the solution of salt; this solution is also troubled by heat, but the precipitate is not dissolved on cooling. As in chemical investigations the *c*-phosphate of soda is so frequently used to precipitate oxides from the solutions of their salts, and as it appeared to me important to be accurately acquainted with the properties of the precipitates, I shall offer no excuse for stating here the reactions of the most important salts of the metallic oxides with a solution of *c*-phosphate of soda.

Solution of chloride of barium produces a copious precipitate, which is neither soluble in excess of the phosphate of soda nor of the chloride of barium.

Solution of chloride of calcium reacts in the same manner. Traces of the precipitate are soluble in excess of the chloride of calcium, and may be precipitated from the filtered solution by ammonia.

Its reaction with a solution of sulphate of magnesia is known generally, but not perfectly in detail. The sulphate produces a precipitate in a solution of the phosphate of soda, which is insoluble in the latter, but soluble in excess of the solution of sulphate of magnesia. If this clear solution be treated with ammonia, a copious precipitate falls, part of which consists of hydrate of magnesia, and is soluble in chloride of ammonium; another portion, which is composed of the phosphate of magnesia and ammonia, is insoluble in it. The clear solution of the phosphate of magnesia in the sulphate of magnesia, when boiled, yields a copious precipitate, which, however, completely disappears as the liquid cools, reappearing if the ebullition be repeated. If, however, this experiment be repeated many times, the precipitate thrown down on ebullition at last ceases to disappear entirely on cooling.

The precipitate produced by nitrate of silver is insoluble both in excess of the phosphate of soda and in the salt of silver.

Solution of pernitrate of mercury produces a white precipitate, which is not insoluble in excess of the solution of the mercurial salt; but, as this always contains free acid, the solubility of the precipitate may arise from this.

Solution of the protonitrate of mercury causes a white precipitate, insoluble in excess of the mercurial solution.

Solution of the bichloride of mercury at first produces no change. After standing for a long period, a slight red deposit subsides, which is produced sooner and in greater abundance by heat. The reaction is the same as with the pyrophosphate of soda.

Solution of sulphate of copper produces a bluish-white precipitate, soluble in a large quantity of the cupreous solution. A copious precipitate is produced by heat in the clear solution, which completely disappears on cooling.

Solution of the protosulphate of manganese produces a white precipitate, which is only soluble in a very large excess of the solution of manganese. A precipitate is caused in this solution by ebullition, which completely disappears on cooling.

Solution of protosulphate of iron produces a white precipitate, which is readily soluble in excess of the solution of the protosalt. A copious precipitate is thrown down by heat, and does not completely disappear on cooling.

In a solution of the perchloride of iron a white precipitate is formed, which is readily soluble in excess of the solution of the perchloride.

Solution of the sulphate of zinc produces a white precipitate, which is readily soluble in excess of the solution of zinc. When the solution is heated a troubling ensues; it is but inconsiderable, and does not completely disappear on cooling.

Solution of sulphate of cadmium causes a white precipitate, readily soluble in excess of the solution of cadmium. The solution yields a copious precipitate when heated, but this completely disappears on cooling.

Solution of chloride of nickel yields a greenish-white precipitate, soluble in excess of the solution of nickel. The solution, which yields a precipitate when boiled, becomes perfectly clear on cooling.

Solution of the sulphate of cobalt produces a blue precipitate, soluble in excess of the solution of cobalt. The solution is red. On ebullition a red precipitate is produced in it, which completely dissolves on cooling.

Solution of alum gives a white precipitate, soluble in a considerable excess of the solution of alum. When heated the solution yields a copious precipitate, which partly, but not entirely, disappears on cooling.

Solution of nitrate of bismuth gives a white precipitate, insoluble in excess of the solution of bismuth.

Phosphate of soda does not cause a precipitate in a dilute filtered solution of albumen, even when acetic acid is added.

The aqueous solution of the *c*-phosphoric acid differs from pyrophosphoric and metaphosphoric acids, as is well known, by its reaction with a solution of silver.

Solution of chloride of barium produces only an inconsiderable turbidness; but on the addition of ammonia a copious precipitate is immediately formed.

Barytic-water causes a precipitate, even when the liquid is acid. The phosphoric acid is not completely separated by carbonate of baryta in the cold. The liquid, filtered at the end of several days, still yields a precipitate on the addition of sulphuric acid.

Solution of chloride of calcium gives no precipitate, even after standing for a considerable time; but ammonia immediately causes a copious precipitate. Lime-water produces a precipitate, even when the liquid is somewhat acid.

A dilute filtered solution of albumen, as we know, gives no precipitate with the solution of phosphoric acid.

A short time since we were made acquainted, by Svanberg and Struve, with an excellent reagent for phosphoric acid in the molybdate of ammonia. This is so delicate in the detection of the smallest trace of phosphoric acid, and is capable of showing its presence even in those compounds in which the acid is discovered with difficulty or cannot be so at all, that an important service has been rendered to analytical chemistry by the recommendation of this reagent.

If a solution of the molybdate of ammonia be added to a solution of any phosphate, and then so much muriatic, or what is better nitric, acid that the precipitate which is formed at first disappears again, the liquid immediately becomes yellow, and deposits, even when the smallest quantity of phosphoric acid is present, a yellow precipitate, which consists of molybdic acid, but which is a different modification, and possesses different properties from the molybdic acid which is obtained when phosphoric acid is not present. If the phosphoric compound to be examined is insoluble in water, it is used in solution in acids, especially nitric acid. The precipitation is accelerated by heat. The yellow precipitate is soluble in ammonia, as also in an excess of the phosphate. Hence only very small quantities of phosphoric acid are most easily detected in this manner; and it is quite possible that a larger quantity might be overlooked, because in this case a very large quantity of the molybdate is requisite to produce the precipitate after saturation with nitric acid.

The yellow precipitate can be readily recognised, even when it is precipitated from a coloured liquid, as from a nitric solution of phosphate of copper, or from acid solutions of other coloured phosphates.

It must, however, be remarked that *c*-phosphoric acid and its salts only are able to produce this reaction. The other modifications of phosphoric acid do not give the yellow precipitate with the molybdate of ammonia, unless they have been converted into the *c*-phosphoric acid by the nitric acid added. As is well known, this often takes place slowly and incompletely in the cold. Hence the pyrophosphate of soda may be allowed to remain for a very long time in dilute solutions with the molybdate of ammonia and free nitric acid, without any effect being perceptible. But if the whole be made to boil a yellow liquid is instantly produced, and soon afterwards a yellow precipitate.

Experiment to separate Phosphoric from Pyrophosphoric Acid.

The different reaction of the phosphate and pyrophosphate of soda towards a solution of sulphate of magnesia and ammonia led me to hope that it might form the basis of a method of separating these two modifications of phosphoric acid.

When pyrophosphate of soda is dissolved in a large amount of water, and the solution is mixed with a very large quantity of chloride of ammonium, no precipitate is produced on the addition of sulphate of magnesia and solution of ammonia. But at the end of a considerable period a precipitate falls, and is deposited firmly upon the sides of the vessel. If, however, the quantity of chloride of ammonium is very considerable, it frequently does not appear for several days.

1.828 grm. of hydrated *c*-phosphate of soda, which had lost a small quantity of its water of crystallization by efflorescence, was dissolved in water with 1.521 grm. of the same salt, which had been previously heated to redness, and furnished 0.611 grm. of pyrophosphate of soda. The solution was mixed with 100 grms. of chloride of ammonium, then diluted with 1,600 grms. of water, and sulphate of magnesia and solution of ammonia added. The precipitate was filtered off after an interval of two hours, then washed, first with water containing chloride of ammonium, afterwards with water containing ammonia. 0.814 grm. of calcined phosphate of magnesia was obtained, which contains 0.516 grm. of phosphoric acid. But the 1.828 grm. of phosphate of soda contains only 0.391 grm. of phosphoric acid: hence a considerable amount of pyrophosphoric acid was precipitated with the phosphate of ammonia and magnesia. This method of separation is consequently inapplicable.

NOTE ON THE COMPOSITION OF SHEA BUTTER AND CHINESE VEGETABLE TALLOW.

By Dr. R. D. THOMSON and Mr. EDWARD T. WOOD.*

Shea Butter.—This substance is a vegetable product of Western Africa, and was brought into notice by the celebrated Mungo Park during his journey in 1796. The tree from which it is procured he describes as very much resembling the American oak, and the fruit (from the kernel of which, being first dried in the sun, the butter is prepared by boiling the kernel in water) has somewhat the appearance of a Spanish olive. The kernel is enveloped in a sweet pulp under a thin green rind, and the butter produced from it, besides the advantage of keeping the whole year without salt, is whiter, firmer, and, according to Park, of a richer flavour than the best butter he ever tasted made from cows' milk. The growth and preparation of this commodity seem to be among the first objects of African industry, and it constitutes a main article of their inland commerce. This butter is abundantly produced, not only towards the Gambia, but also in the countries adjoining the Niger, as it is mentioned by the Landers and other recent travellers. Mr. John Duncan, who penetrated by Dahomey, describes the tree as resembling a laurel, and growing to the height of eighteen or twenty feet. The leaf is somewhat longer than the laurel and a little broader at the point. The nut is of the size and form of a pigeon's egg, and of a light brown colour; the substance of the shell about that of an egg. The kernel when new is nearly

* Read before the Philosophical Society of Glasgow.

all butter. The shell is crushed from the kernel, which is also crushed and boiled with a little water in a pot for half an hour; it is then strained through a mat, when it is placed in a grass bag and pressed. A good-sized tree will yield a bushel of nuts.

Shea butter appears to be the same as that which is called Galam butter, and is derived from a species of Bassia; but the species has not yet been made out, as no specimens of the flower and fruit have reached botanists. The oil upon which the following experiments were made was obtained through the kindness of Dr. Carson, of Liverpool, from Mr. Jameson, formerly of this city, and now of Liverpool, whose benevolent exertions for the improvement of Africa are so well known. The colour of the oil is white with a shade of green. It is solid at the usual temperature in this country; at 95° it assumes the consistence of soft butter, and at 110° is a clear and liquid oil. When boiled in alcohol the greater part is dissolved, and crystallizes on cooling in needles: it dissolves in cold ether, and separates in needles by evaporation. The oil was saponified by means of caustic potash in a silver basin; the soap separated from its solution by common salt and decomposed by tartaric acid. After being crystallized out from alcohol five or six times, and freed by pressure from adhering oleic acid, the acid was obtained in fine pearly scales fusing at 142°: it was united with soda, and yielded a salt in fine pearly scales. Its atomic weight was estimated by means of the silver salt. In the first, second, and third experiments the silver salt was formed by precipitating an aqueous solution of nitrate of silver by an aqueous solution of the fatty acid united to soda. In the fourth and fifth experiments an alcoholic solution of the acid was precipitated by a solution of nitrate of silver in alcohol, and hence the excess of acid.

I. 3.73 grains of silver salt gave 1.05 metallic silver = 1.126 oxide of silver = 30.19 per cent. AgO.

II. 10.65 grains of silver salt gave 3.01 silver = 3.221 oxide of silver = 30.23 per cent. AgO.

III. 2.85 grains gave .861 AgO = 30.21 per cent.

IV. 4.71 grains gave 1.30 silver = 1.394 AgO = 29.53 per cent.

V. 2.72 grains gave .743 silver = .797 AgO = 29.30 per cent.

The following table will express the percentage composition of the silver salt by these five experiments:—

	I.	II.	III.	IV.	V.
Acid	69.81	69.77	69.79	70.41	70.70
Oxide of silver..	30.19	30.23	30.21	29.59	29.30

Taking the mean of all these experiments, the constitution of the silver salt will be—

Acid	70.10
Oxide of silver	29.90

and the atomic weight of the anhydrous salt is—

Acid	33.97
Oxide of silver	14.50
	48.47

or, leaving out the two last determinations, we shall have as a mean for the three higher results the atomic weight of the acid equal to 33.82. To determine the composition of the anhydrous acid, the three following analyses were made by means of oxide of copper and chlorate of potash:—

I. 2.85 grains of silver salt gave HO = 2.30 grains and CO_2 = 5.73 grains.

II. 3.91 grains of silver salt gave HO = 3.39 grains and CO_2 = 7.87 grains.

III. 3.667 grains of silver salt gave HO = 3.058 grains and CO_2 = 7.334 grains.

The following table gives the composition of the above salt in 100 parts:—

	I.	II.	III.	Mean.	Anhydrous acid.
C.....	54.73	54.88	54.54	54.71	77.83
H.....	8.94	8.78	9.22	8.98	12.77
O.....	6.12	6.75	6.94	6.60	9.40
AgO...	30.21	29.59	29.30	29.71	

From the facts which have been stated in reference to the acid contained in the shea butter, it is obvious it is margaric acid, the same substance which is found in the human fat and in butter. There is little doubt that on examination this acid will be found extensively distributed in the vegetable kingdom: its presence in the shea butter may assist in explaining the statement of Park, that this substance when fresh is equal in taste to butter.

Chinese Vegetable Tallow.—This is a solid oil, long known to those who are acquainted with China, where it is extensively used for making candles. It is derived from the seeds of Stillingia sebifera, which, according to Fortune ("Wanderings in China," p. 65), are pulled in November and December. They are placed in a wooden cylinder with a perforated bottom over an iron vessel filled with water, which is boiled and the seeds well steamed to soften the tallow; in ten minutes they are thrown into a large stone mortar, and beat with stone mallets to separate the tallow from the other parts of the seed; the tallow is thrown on a sieve heated over the fire and sifted, and is then squeezed out by a peculiar process. As imported it is a hard, white, solid oil, with a green shade. It fuses at about 80°. The oil was saponified, and the acid separated and purified, according to the method already noticed. A soda salt was formed, and from this a silver salt was precipitated. 14.38 grains of this salt when burned left 4.03 grains of metallic silver, which gives the following for the composition of the salt:—

		Atomic weight.	Per cent.
Oxide of silver ..	4.328	14.50	30.03
Acid.....	10.052	33.67	69.97

The acid was not quite pure; for when heated it softened at 143°, became very soft at 149°, of the consistence of cream at 150°, and quite fluid at 154°; it obviously, therefore, retained some stearic acid, but must have consisted principally of margaric acid, as stearic acid fuses at 167°. There is no doubt that both of these oils might be advantageously employed in soap-making, the supply apparently, from the statements of the traders, being unlimited.

ON THE VANADIATE OF LEAD AND THE DOUBLE VANADIATE OF LEAD AND COPPER.

By M. IGNACE DOMEIKO.

The formation of secondary porphyry of Chili, which has been already remarkable for specimens of the native amalgam of Arqueros, and of iodide of silver of Algodones, also contains a very rich formation of vanadiate of lead and of copper.

The mine in which these specimens were discovered is twelve kilometres to the east of the silver mines of the Arqueros, and is known by the name of the Mina Grande, or Mina de la Marqueza, and was considered as one of the richest silver mines in Chili. A miner who was about to recommence working the mine found a heavy yellow mineral, which he brought to Coquimbo for analysis. It was found by M. Domeiko to be very poor in silver, but contained vanadium.

This mineral is of a dirty yellow colour, sometimes of a sulphur-yellow, or slightly orange or greenish; its powder is of a yellowish-white colour; its texture is compact, sometimes slightly earthy, and sometimes of a weak resinous lustre. It contains numerous irregular cavities, the interior of which is always incrusted with a brownish matter, often consisting of globular concretions; the mass sometimes exhibits greenish earthy particles, coloured by carbonate of copper, and also white carbonate of lead.

Before the blowpipe the mineral fuses with intumescence into a grey metallic scoria, slightly frothed, and giving a blue colour to the flame. On charcoal, with the addition of carbonate of soda, there are obtained a perfectly malleable button of lead, and a yellowish-grey scoria; when melted on a platina wire, with the salt of phosphorus, it yields a transparent bead, which assumes a fine green colour in the interior flame, and becomes yellowish brown in the exterior flame; when heated in the matras it yields a little water derived from the argillaceous gangue; nothing sublimes in the open tube.

Dilute nitric acid dissolves it readily, even when cold, without producing either effervescence or nitrous vapours, and leaves only a residue of brownish or reddish gelatinous matter. Acetic acid has no action upon it. The action of sulphuric acid determines the absence of fluorine.

The process which succeeded best in analyzing this mineral was the following:—

The mineral reduced to an impalpable powder is treated with cold dilute nitric acid, and digested for twenty-four hours; it is then to be gently heated and filtered to separate the ferruginous clay unacted upon. The chlorine is to be determined by nitrate of silver, the excess of which is to be precipitated by a little hydrochloric acid. The greater part of the lead is then to be precipitated by sulphuric acid; the filtered liquor is to be largely diluted, and sulphuretted hydrogen is to be passed through it cold, and the operation is to cease as soon as the lead and copper are precipitated; filter and precipitate the arsenic by saturating and repeatedly heating the solution. Evaporate the filtered liquor to dryness; treat the residue with hot dilute nitric acid, dilute the solution, and precipitate with excess of ammonia the phosphates of lime, zirconia, iron, and alumina (A). The filtered liquor is concentrated, and a fragment of sal-ammoniac is immersed in it, with the addition of a few drops of ammonia. The vanadium is immediately precipitated in the state of vanadiate of ammonia, which is to be collected on a filter and washed, at first with a saturated solution of sal-ammoniac, and then with alcohol. The solutions containing sal-ammoniac are evaporated and the residue slightly calcined. Water is then to be added, which separates a little silica, and the phosphoric acid is to be determined by iron according to Berthier's process. As to the precipitate (A), if it contain a notable quantity of vanadium, it is to be redissolved in nitric acid, and to be again precipitated by excess of ammonia, &c. In the opposite case it is to be fused with one part of silica and three parts of carbonate of soda, and treated with water; phosphoric acid is to be sought for in the alkaline liquor, and the insoluble residue, composed of silica, alumina, lime, oxide of iron, and zirconia, is to be analyzed.

The mean of several analyses yielded:—

Chloride of lead	9.05
Oxide of lead	58.31
Oxide of copper	0.92
Arsenic acid	11.55
Phosphoric acid	5.13
Vanadic acid	1.86
Lime	7.96
Alumina, zirconia (?), traces of oxide of iron	1.10
Argil.....	2.00
Water	1.12
	99.00

The presence of copper in the above-described mineral induced the author to examine whether vanadiate of copper might not be found among the accompanying minerals, this mineral having been stated to exist in Siberia.

The green earthy portions were first examined, and these were associated with traces of vanadium; other portions examined did not contain more, and M. Domeiko was about to give up the examination, when he found that the blackish-brown portion, which he had taken for ferruginous argillaceous gangue, was much richer in vanadium than the yellow mineral.

This substance is amorphous, porous, heavy, of a more or less deep blackish-brown colour, and of a texture which is either compact or earthy; by the heat of the taper it melts into a black bead, which is somewhat frothed. By the blowpipe it gives a green bead, with phosphorus salt, a cupreous globule of lead upon charcoal, and in the matras it yields a little water. It is

rather soft, and its powder is brownish yellow. It lines the cavities of the yellow arseniophosphate mineral, and is frequently associated with the amorphous carbonates of lead and copper. At first sight it is mistaken for hydrate of iron, from which it differs by its great fusibility, its ready solubility in dilute nitric acid, and its reaction with the blowpipe, &c.

The mean of two analyses gave as its composition :—

Oxide of lead	53.43
Oxide of copper	15.78
Vanadic acid	13.41
Arsenic acid	4.64
Phosphoric acid	0.64
Chloride of lead	0.33
Silica?	1.16
Lime	0.54
Oxide of iron, alumina, &c.	3.46
Argillaceous residue	1.26
Water	2.70
	97.35

From these results the author is induced to suppose that the above mineral contains a double vanadiate of lead and copper, the composition of

. ...

which approaches the formula $Pb_6V + Cu_6V$, or $Pb_2V + Cu_2V$.—*Ann. des Mines*, tom. xiv., and *Phil. Mag.*

ON THE PREPARATION OF COLLODION.*

By J. B. EDWARDS, F.C.S., M.P.S., &c.

Much difference of opinion appears to exist among some distinguished French chemists as regards the solubility in ether of the ordinary explosive gun-cotton, as described by Mr. Maynard, in America ; but since the discovery of M. Mialhe's process with nitrate of potash I am not aware of any experiments having been made on the subject, and therefore trust my experience may be of some interest.

In *L'Union Médicale*, of the 7th September last, M. Malgaigne says, "The *American Journal of the Medical Sciences* contains an extract from a letter by Mr. Maynard, containing a formula for the preparation of collodion, which might be supposed to be authentic. According to this formula the cotton is to be treated with nitric and sulphuric acids, dried, and dissolved in pure sulphuric ether."

Upon reading this letter I lost no time in applying to M. Foy, Pharmacien to the Hôpital St. Louis, to obtain a quantity of this liquid, but he in vain attempted to prepare it, either from the acids united or the nitric alone. I afterwards prevailed on MM. Dublanc and Mialhe to undertake its preparation, but they were no more successful, and it was evident that a formula which failed successively in the hands of three such distinguished chemists was incorrect ; M. Mialhe, however, undertook, at my request, the investigations which led him to the discovery of the method by nitrate of potash and sulphuric acid, which has always proved successful. The cotton so prepared does not deflagrate as usual, and leaves behind a carbonaceous residue on combustion. The explosive cotton he found insoluble in ether.

In the same periodical, shortly after, appeared a notice from M. Salmon, surgeon to the Hôtel Dieu of Chartres, who states that, "contrary to the experience of MM. Foy, Dublanc, and Mialhe, I assert that collodion may be easily prepared by dissolving gun-cotton made by the mixed acids in sulphuric ether. I have always prepared the adhesive liquid by the method of the American author. The preparation of collodion, according to the process of MM. Millon and Gaudin, revived by M. Mialhe, is not always practicable, and is liable to great variations from the inconstancy of the product."

On the above, Soubeiran, in the same journal, observes :—

"I, like many others, have attempted to operate with a mixture of the monohydrated nitric and sulphuric acids. I have employed them sometimes with equal weights, at other times with equal volumes, and immersed the cotton for different periods, from three minutes to an hour, and I have never found it to dissolve in ether. I do not, however, contend that it is impossible to do so, but I must think the other a more certain method, though the employment of the mixed acids has the advantage of convenience over the other."—*P. T.*, vol. iii., No. 107, p. 665.

Professor Simpson states that "usually an ounce of strong sulphuric ether will dissolve thirty grains or more of gun-cotton in the course of a few hours ; but to form a complete pulp it will require to stand for a day."—*Pharmaceutical Journal*, vol. viii., No. 2, p. 86.

My own experience coincides with that of M. Salmon. I take equal volumes of strong sulphuric and strong fuming nitric acids, mix them in a mortar or other convenient vessel, then immerse finely-carded cotton in small portions, allowing each to remain about one minute, then plunging it into a large quantity of water, and teasing it out with a glass rod, so as to become as loose as possible, yellow fumes arise from the cotton, and are washed away, and it is then perfectly white. This is then well washed from acid and dried, and it then instantly and perfectly dissolves in commercial sulphuric ether, forming either a semi-solid jelly or thick liquid, according to the quantity of ether added. This is the constant and uniform result of several experiments I have made.

This cotton is also highly explosive, and leaves no carbonaceous residue, when fired.

The sources of fallacy, I imagine, are, either from employing weak acids, too long immersion, or ether of high rectification. The latter should not contain water, but sufficient alcohol to reduce its specific gravity to about 760° or 770°. Its solvent action is then instantaneous, and not, as Simpson states, from three hours to a day !

I consider this process superior on many accounts to that of Mialhe. It is more readily prepared, and requires less washing than when entangled with sulphate of potash. It is explosive, and therefore answers both purposes. I have dissolved some with equal readiness that has been thus prepared more than a month ; so that it may be convenient to keep the cotton prepared, and dissolve small quantities as frequently as required, and thus obviate the loss by vaporization which ensues on keeping a stock of the solution prepared.

I was led to make these experiments for Mr. Higginson, surgeon, of Liverpool, who recently exhibited at the Literary and Philosophical Society some evaporated collodion under the microscope, which had all the appearance of distinct and definite acicular crystals ; and Mr. H. stated that he had made very frequent examinations, and observed an uniformity in their shape and arrangement, which convinced him that these were crystals of collodion, and not filaments of cotton.

It was suggested that there might be minute crystals of nitrate or sulphate of potash, and I, therefore, undertook to prepare some collodion without any salt to interfere : in this I have succeeded ; but have not yet heard the result of Mr. Higginson's more recent investigations.

Allow me to caution those who are not in the habit of preparing gun-cotton as to its highly explosive nature. The gaseous results of combustion, which of course at once occupy a very large space in the air, are thus given off at a very high temperature, so as to possess the property of inflaming other portions of cotton at a very considerable distance ; and thus, on trying whether the cotton is sufficiently dry, by exploding a small portion, it should be removed for some distance from the remainder, or the whole will ignite, and if the operator be standing over it his face may be severely burned, though no flame reaches it, the resulting gases being quite capable of blistering the skin. It is better to operate on small portions at once.

* From the *Pharmaceutical Journal*.

THE CHEMICAL TIMES.

SATURDAY, MAY 12, 1849.

THE PROFESSIONAL LIFE ASSURANCE COMPANY.

About two years ago a body of gentlemen ventured upon the hazardous and most arduous undertaking to establish a Life Assurance Company that should be perfectly free from the many and gross defects which were but too plainly *seen* and *felt* to impede the beneficial working of the then existing companies. A more unpropitious time for such an undertaking could not well have been selected :—England was verging on a famine, Ireland felt the actual pangs of it ; the money market was tight and cramped in the extreme ; bankruptcies were the order of the day ; public confidence was thoroughly shaken. Truly, the aspect of the times was unpromising enough, and such as would have damped the ardour of most men. But the projectors of the new company were not to be deterred from their purpose by the consideration of even the most serious obstacles in the way of their enterprise. Basing the infant institution upon equitable and liberal principles, they proceeded with their arduous task, confident that the thinking portion of the community would speedily discover and know how to appreciate the great and *solid* advantages of the projected *new* over the *old* system of assurance. We are happy to find that these expectations have been fully realized, and that, after an existence of only two years, the new company occupies now already a prominent place among institutions of the kind.

The Professional Life Assurance Company is, as its name indicates, more especially devoted to the medical, military, naval, legal, and clerical professions, although the range of its operations is by no means confined to these professions, but extends through every rank and grade of society.

As we have already stated, the Professional Life Assurance Company is established upon liberal and equitable principles. A judicious combination of the *proprietary* and *mutual* systems constitutes its basis. The inducements and advantages which it offers, particularly to professional men, are manifold, and mostly of a high order. According to its rules, no policy will ever be granted upon insufficient statements, or such as will not bear the strictest investigation. But, the policy once granted, the company renounce all right to dispute the claims of the holder, except in a clear case of personation. Death of the assured by the hand of the law, by suicide, or by duelling, will not wholly deprive the survivors of the advantages which the deceased intended should accrue to them. In all such cases the company engages to refund the whole of the premiums paid.

But it is not alone for the *survivors* that provision is made by this most excellent institution : the *assured himself* may benefit by it during his lifetime, the institution effecting assurances against those bodily and mental afflictions which but too often befal the professional man. A benevolent fund is, moreover, set aside from the accumulated profits of the

society, to provide the means of affording relief in certain contingencies to the assured, or even to their widows and orphans; so that, if any of the assured should, from adversity, be deprived of the means of continuing the payment of their premiums, this will not of necessity deprive them of the advantages which they themselves or their survivors might have hoped to derive from the investment.

Another, and a most distinguishing, feature of the Professional Life Assurance Company is its invariable practice of remunerating medical men for their reports.

The new company show themselves equally liberal in the matter of policy stamps, no charge for such stamps being made to the assured.

As regards the *stability* of the new company, we find that this is fully and amply secured and guaranteed by a capital of £250,000, *actually subscribed for*, with a proprietary body of upwards of five hundred shareholders.

In short, the whole of the principles and rules of the Professional Life Assurance Company are so perfectly fair, equitable, and liberal, that we deem it our duty to recommend it most strongly to the attention of our readers. The members of the medical, chemical, and pharmaceutical professions will not readily meet with a *safer* and *more profitable and advantageous* investment of their savings than that afforded by this institution.

PARIS ACADEMY OF SCIENCES.

ON THE EMPLOYMENT OF GUN-COTTON IN FIREARMS. BY M. MORIN.

When gun-cotton is submitted for some time to a temperature which, according to M. Payen, is from 50° to 60° Centigrade (122° to 140° Fahrenheit), for ordinary gun cotton, and from 60° to 80° Centigrade (140° to 176°) for the purest and most carefully-prepared gun-cotton, a slow but continuous decomposition takes place, which terminates with a spontaneous explosion.

The fears and necessary precautions respecting its employment which M. Piobert and myself have repeatedly expressed, as to the dangers and inconveniences which would arise from the manufacture and employment of the gun-cotton and other similar preparations, are not founded on the accidents which have arisen from its use, but from the careful study of the effects produced by explosive substances in general.

Officers of artillery have long known that they could not with impunity increase the rapidity of the combustion of powder; and experience shows that in 1826 and 1827, when attempts were made with more powerfully explosive powders for those previously in use, that the bronze cannons could not withstand the force of these new powders.

M. Piobert, in his interesting researches on the effects of gunpowder, has shown that the greater the rapidity of combustion of the powder, the greater is the tension of the gases formed at the moment of the displacement of the projectile, and the more destructive to the cannon. He was led, from these considerations, to propose a new method of charging, which consisted simply in augmenting the space occupied by the charge, in order to diminish the maximum tension of the gases at the instant of the escape of the ball. Experience has justified the value of these recommendations, by proving that bronze cannons of the largest calibre could, with this mode of charging, be fired nearly 3,000 times without injury, whilst 300 discharges were often sufficient to render them useless. On applying the same considerations to the effects of gun-cotton, the rapidity of whose combustion is so great, he arrived at conclusions precisely of the same kind, but still more decided.

It is on account of those opinions, based on theory and practice, that, since some chemists have presented to the Academy several samples of gun-cotton to replace the ordinary powder for fire-arms, insisting as fully on their excess in energy or force, we now state that what these chemists regard as a good quality we regard as a great fault, and of a nature to give rise to much danger. These fears have been but too fully justified by experience.

The first accidents which arose in the manufacture of gun-cotton were especially in the process of the drying. The spontaneous explosions observed in the stoves, the mean temperature of which did not exceed 75° to 80° Centigrade (167° to 176° Fahr.), were, on account of the favourable reception this new product received, accounted for by reasons more or less probable; nevertheless, it must be remarked that this temperature was precisely that which M. Pelouze now regards as that which inevitably announces an explosion. But the accident in the drying-house at Bouchet, heated by steam, and in which a higher temperature than 45° to 50° Centigrade (130° to 122° Fahr.) could not be obtained; the explosion of the small magazine in the forest of Vincennes, surrounded by palisades, into which no person had entered for several days, and which spontaneously exploded on a Monday, at five o'clock in the morning, after having been completely isolated during the whole of the preceding Sunday;—these two explosions, I say, now receive a natural explanation, for the facts recognised by MM. Payen and Pelouze, and stated at the commencement of this communication.

I will not speak of the accident at the works at Dartford, the drying-room of which was not heated higher than 140° Centigrade, nor of that which more recently occurred at Bouchet, and was the cause of the loss of life to four persons employed in packing the gun-cotton.

The researches of MM. Payen and Pelouze establish the fact that gun-cotton cannot, without danger, be exposed for any length of time to a temperature of 50° to 60° Centigrade. Now, would not the artillery-waggons, and even the magazines themselves, often be subjected to a temperature as high as this? Gunpowder, which is, and with reason, considered so dangerous to keep, will not explode at a lower temperature than 300° Centigrade (572° Fahr.), a temperature which cannot possibly be produced by causes independent of human instrumentality, and, therefore, an instance of spontaneous combustion of powder is unknown.

If, from these consequences, arising from the keeping of the gun-cotton, we pass on to the consideration of the effects produced by its use in firearms and artillery, we shall here find a complete confirmation of our views.

We will first call to mind that an iron proof mortar burst and wounded an artilleryman, from the effect of a charge of only 46 grammes (1½ ounces) of gun-cotton, whilst mortars of the same kind have been discharged with 92 grammes (3 ounces) of powder without one having burst. From the dimensions of these mortars the tension of gas capable of producing this bursting was not less than 4,000 atmospheres. About the same time a small wrought iron proof mortar, charged with 6¾ grammes of gun-cotton, burst, wounding a workman, and nearly killed several artillery officers. Calculation shows that the tension of gas was at least from 4,000 to 5,000 atmospheres.

Numerous trials have been made with the greatest possible care, by a commission of artillery officers, assisted by MM. Pelouze and Coombes. Various experiments, both as regards the firearms, the quantity employed for charges, and the composition of the explosive substances employed, were made, and, although the labours of the commission have not yet terminated, I am able to furnish some of the principal results.

For muskets it was first ascertained, by the aid of the balistic pendulum, what was the charge of gun-cotton which would give an infantry musket ball the same rate of velocity as a charge of 8 grammes of military powder, and this was found to be 2.86 grammes. This done, charges of the same amount were fired from muskets with barrels of decreasing lengths, from that of the ordinary infantry musket barrel, which is 1.083 metre in length, and regulated by relation to the calibre or diameter of the ball; 64, 49, 32, 29, 22, 16, 11, 7, 5, and 4 times the calibre.

The rates of velocity given to the balls were indicated by means of the balistic pendulum always firing at the same distance.

From the results furnished by these experiments, the force communicated to the balls by the same charges, and with different lengths of barrel, could be determined, which very soon proved the effects of the rapid combustion of the gun-cotton, and showed at the first instant of the discharge of the ball that the tension of the gases developed by this substance was more than double (at least 2.30 times) that of the gases developed by gunpowder.

It was also proved that with charges exceeding 4 to 5 grammes of gun-cotton the balls were completely deformed, and often divided into several irregular fragments, a circumstance which rendered the firing very uncertain. On continuing, notwithstanding this, to fire with increased charges, we found that almost all the musket-barrels burst at the first discharge, with a charge of from 7 to 7½ grammes of gun-cotton, whilst, in the ordinary proof trials, these barrels withstood a charge of 27½ grammes of fine sporting powder. Now, in battle, it not unfrequently happens that a musket has at the same time two or three charges, which, in the case of gun-cotton, would be attended with most serious consequences.

But, besides this, it has been found by long experience that an ordinary infantry musket can be fired off from 25,000 to 30,000 times, with a charge of 8 to 10 grammes of military powder, without bursting; whilst experience has also shown that, after 500 discharges with the weak charge of 2.86 grammes of gun-cotton, almost all the musket-barrels have burst. These results are doubtless sufficiently conclusive, without further insisting on them. I will only add that various trials were made by the artillery to diminish the rapidity of the combustion of the gun-cotton, in employing it carded, more or less compressed, spun, twisted, woven, reduced to a pulp, in small pieces, in powder, &c.; that experiments were also made with hemp, sawdust, &c., as substitutes for cotton, and that all these attempts failed; some of the products being less powerful, more variable in their effects, and yet quite as dangerous as the carded gun-cotton, if not more so.

As to the azotic paper, which M. Pelouze considered as more powerful than powder, we have tried it, made of different kinds of paper, and have experimented on some prepared by M. Pelouze himself. The results of the firing with this substance have been very irregular, always inferior to those in which gun-cotton was employed, and generally of no effect whatever; the balls were scarcely driven from the muskets.

To the experiments made with firearms succeeded trials made with bronze cannons, the usual charge of powder for which is 2 kilogrammes (nearly 4½ lbs.). According to the preceding observations, the equivalent charge of gun-cotton should be about 700 grammes (about 23 ounces), but it was thought more prudent to commence firing with charges of 200, 300, and 400 grammes. It was first ascertained that the density most suitable for obtaining the maximum velocity with the gun-cotton was that of 0.33, as in the case of the muskets. After 5 discharges only at this density, and using 400 grammes for a charge, the cannon began to show signs of wear. Five more discharges were made, using the same charge, at a density of 0.500. The symptoms of wear rapidly increased, and, after 15 charges of 500 grammes, 15 of 606

grammes, and 10 of 700 grammes, an opening of 1½ inches in length, and more than an inch in width, appeared; thus this cannon, after no more than 55 discharges had been fired from it, was completely destroyed.

In presence of these results I am of opinion that there can be no doubt as to the destructive effects produced by the gun-cotton on firearms—effects surpassing all precautions; thus proving, both from the dangers of its manufacture, its keeping, and its employment, the correctness of the opinion we had formed from the first of the dangerous properties of the gun-cotton.

In reference to the above, M. Gaudin states that there exists a very great difference between the various kinds of gun-cotton, from that of the simply explosive (*fusant*), to that of the fulminating (*fulminant*), the former being obtained by immersion of the cotton in the concentrated sulphuric acid of commerce mixed with saltpetre; and the latter by dipping the cotton in a mixture of monohydrated nitric acid mixed with nordhausen or fuming sulphuric acid; the formation of this latter product appearing also to take place instantaneously.

"Indeed," says M. Gaudin, "that which I have prepared was allowed to remain but a few seconds in the mixture of the acids—just a sufficient time to allow the cotton to imbibe the liquid—then quickly removed, and washed in a large quantity of water."

The gun-cotton so prepared forms a kind of fulminating powder, which bursts the firearms in which it is employed. In an experiment made by M. Lelong, the pistol was shattered to pieces by the first discharge. It would, therefore, appear very important to ascertain with certainty whether the transformation of the cotton into an explosive substance always takes place instantaneously, and if its energy is proportioned to the concentration of the mixed acids, as I am of opinion it is. If so, it would appear certain that every kind of gun-cotton would be composed of a series of explosive substances of different degrees of strength; the portion of cotton first moistened being the most energetic, and the remaining portions each diminishing in force, down to the portion last brought under the influence of the acid mixture, which would be simply explosive (*fumant*) substance, or xyloïdine. For the same reason, the fulminating paper would be also composed of layers or strata of different degrees of strength. Adding to this the imperfect manner in which the paper could be washed, from the compressed state of its fibres, it would readily be seen that paper must always be inferior in its balistic effects to gun-cotton, especially when brought to act in free projectiles.

The spontaneous combustions which have taken place appear to me to be entirely due to an imperfect washing of the cotton after its removal from the acid mixture.

FILTRATION AND PURIFICATION OF OILS.

It is known that those vegetable oils intended to be used for lamps, and particularly linseed oil, should be subjected to the action of sulphuric acid, which improves the colour, and facilitates the burning. It is afterwards filtered. The oils that are not intended to be burned also require filtering after their extraction, in order to clarify them, and take away impurities, which cannot be removed by merely allowing it to settle, and pouring it off. Formerly this filtering process was effected by pouring the oil on layers of sawdust, of different degrees of thickness, covered with a little hemp. Sometimes layers of cotton were used. This filtering process is usually repeated, and it proceeds very slowly. The operation of filtering and the clarification of oils, which is an integral part of the purification, was in this state when M. Fonoielle invented a filter, which, in the first instance, was intended for river water. The part of this filter which was really new was the making use of the pressure of more than one atmosphere, obtained by the column of liquid to be filtered. This simple arrangement increased the produce in the proportion of seventeen to one. The idea was afterwards entertained of replacing the pressure produced by the column of liquid by the pressure afforded by air compressed by a forcing-pump. It would naturally be supposed that the filters of Fonoielle, producing in a given space of time seventeen times more than others, would require proportionately more frequent cleaning; but this was not the case, because, during the pressure, the whole mass of filtering materials assisted in producing the required effect. It is, indeed, requisite to clean the layers of filtering materials frequently, and it is impossible this should be otherwise; but M. Fonoielle invented an ingenious method of cleaning the filters without taking the apparatus to pieces. This Fonoielle filter was pronounced excellent when applied to the purification of water, and it was soon considered desirable to extend its application to the clarification of oils; but the height requisite to be given to the column of oil, in order to procure the proper degree of pressure, became a serious inconvenience when the weather was cold. The oil, in fact, would become congealed, if care were not taken to keep it sufficiently warm. Now, the height of the column of oil was at least upwards of eleven yards, a very inconvenient height, as the purification of oil is generally effected in very confined situations; besides, the method of cleaning the filters, which did very well in filtering water, is not attended with the same advantage with respect to oils, on account of their greasy nature.

In the method of filtering oils adopted by Fonoielle, the fluid enters through the lower part of the filter, and the lower filtering layer is the first which is choked up and filled with the dregs, so that, if cleaning is necessary, the whole filter must be taken to pieces. It is alleged that by pressure all the layers contribute to the cleansing; the answer is, that in filtering oil such an effect should be avoided; the first layers should stop the most of the impurities, and be of such materials that a slight pressure should extract the dirt when they require cleaning. By admitting the liquid at the lower part of the apparatus, it is requisite to use a strainer above, by which the filtering materials may be retained in their places, as the pressure from below tends to force them upwards. The strainer should be held down by a screw, and, if it be turned too tight, the layers, by being squeezed together, will not allow the fluid to pass through them readily, and the action of the filter will consequently be retarded, though the oil that does come through is of good quality.

Subsequent improvements have been made in this filter, with the following results:—MM. Hardempont, the widow Decejean and Son, purifiers of oil at St. Quentin, having been informed of the new method of filtering, and being also acquainted with the high expectations of the French company who make use of the Fonoielle process, were desirous of accurately ascertaining the results previously to entering into any arrangement. They sent M. Béranger, the director of the mechanical part of their manufactory, to the establishments of other oil-purifiers who adopted the plan of Fonoielle, and requested that, after he had made the requisite investigation, he would endeavour to ascertain if it were not possible to obtain the same result by the adoption of other methods which would be exempt from the inconveniences that we have pointed out; and they placed at his disposal the apparatus which he might require for the purpose.

M. Béranger, stimulated by his patrons, conceived the idea of filtering in an inverse manner to the method adopted by M. Fonoielle, and of regularly employing the atmospheric pressure, by making a vacuum below the filtering beds. By adopting this plan very successful results were obtained. On this filter the vacuum is not effected with steam, but by a suction-pump, which has at the same time a forcing power; that is, the oil—which is continually drawn into a reservoir below the filtering beds—enters the pump, and the piston, in ascending, forces it into another reservoir, whence the contents, properly clarified, are drawn off by a stopcock.

The filtering-beds, composed of animal and vegetable charcoal, of sand, gravel, of sawdust, and hemp, are placed till they are sufficiently thick in a cylindrical vase of cast iron. The pump is rotative, so as to facilitate its use, and one man alone is very well able to keep it in action for a day, which would be a very insufficient power for a forcing-pump.

With this apparatus, which is so simple, the filtering cylinder being nearly one metre in diameter, in the course of twelve hours more than 50 hectolitres (1,100 gallons) of perfectly clear oil can be obtained, superior to any ever obtained before. The quantity produced by the Fonoielle filter does not exceed 20 hectolitres (440 gallons) in twelve hours. With respect to the oils intended for lighting, they must always be acted on by sulphuric acid, but only half the quantity commonly used is required. The pump has a piston, which is twelve centimetres (4½ inches) in diameter. The thickness of the filtering layers is upwards of two yards. The clarification of fish oils—the consumption of which is now prodigious, and which, in consequence of the expense of vegetable oils, is now used for lighting—can also be greatly improved by the new method of filtering.—*Patent Journal.*

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Robert Angus Smith, of Manchester, for covering or coating the interior surfaces of metallic pipes with coal-tar. Patent dated October 19th, 1848. Enrolled April 10th, 1849.

The patentee proposes to cover or coat the interior surfaces of metal pipes intended for the conveyance of water, &c., with coal-tar, to protect them from the oxidizing action of the water, &c.

The process, as stated by the patentee, is as follows:—

Ordinary coal-tar is distilled until it acquires a thick, pitch-like consistence. The thick tar is kept melted in a suitable vessel, of sufficient capacity to receive the pipes to be coated, beneath the surface of the coal-tar. The vessel is maintained at a heat of about 300° F. The interior surfaces of the pipes to be coated are cleaned from oxide, &c., by any known means, so as to present a bright, clean, metal surface. The pipes are heated by a stove, or other means, to about 300° Fahr., and then placed in the melted coal-tar, where they are allowed to remain for about one hour. At the end of this time they are removed from the vessel containing the coal-tar, when a coating of it will be found to adhere closely to the surface of the pipes. The patentee proposes also to pour linseed oil over the surfaces of the pipes (immediately after taking them out of the coal-tar-bath), for the purpose of removing therefrom the superfluous coal-tar. In place of heating the pipes to the temperature above stated, previous to placing them in the coal-tar, the patentee states he sometimes places them at once, while at the ordinary temperature, in the bath, and then allows them to remain until a short time after they have acquired the temperature of the coal-tar (the whole time being about one hour and a half), when they are removed, and treated as before stated.

The patentee claims:—

The covering or coating the interior surfaces of pipes with coal-tar by the aid of heat.

John Ashby, of Carshalton, in the county of Surrey, miller, for certain improvements in machinery applicable to cleaning grain and dressing meal. Patent dated October 12th, 1848. Enrolled April 12th, 1849.

The cleaning of grain is usually performed by what is commonly known as the "smut ma-

chine," which consists of two vertical concentric cylinders of wire cloth, the outer one being fixed or stationary, while the inner rotates within it. The wheat being introduced at the top, by a suitable channel, passes down through the space between the cylinders, and, during its descent, the smut particles become reduced to dust, and are forced through the outer cylinder. Now, the first subjoined improvement in this part of the grain-cleaning machine consists in the construction of the rubbing surface of these cylinders, by which the machine is rendered more lasting, easier of repair, and also performs its work in a more satisfactory manner. The improved surface is formed by combining together a series of vertical angular bars (being in the direction of the length of the cylinders), secured together, and placed on the surfaces of the cylinders. For this purpose the patentee prefers bars with triangular cross section. Other forms of bars presenting angles may be employed, such as square, rectangular, &c., but the patentee believes the triangular to be the best suited for the purpose. The bars are connected with each other by strips of thin sheet metal, laced or interwoven with them, in the manner of wicker work, and by which they are bound firmly together, but with small interstices between each, according to the thickness of the metal strips. Two or three of these strips are placed in close proximity, but disposed in sets at distances throughout the length consistent with the requisite strength. In preparing this angular fabric, the patentee prefers it being made in segments of about the third of a cylinder, by which it is very readily placed on the surfaces; the ends of the metal strips, being allowed to project, are turned up at right angles; and when secured to the cylinders are clamped together by longitudinal bars, bolted to each other, and forming the connection of the segments before mentioned. Rapid motion being communicated, as usual, by a shaft to the internal cylinder, the grain, in its descent through the space between the two cylinders, is violently beaten by the angular projection, by which the coating of the grain is speedily cleansed from dirt and all extraneous matters; at the same time the smut particles become pulverized, and partially driven through the interstices between the angulars bars of the external cylinder, and enter the outer casing. The grain on passing out at the bottom is received on an inclined shoot, which delivers it at about the centre of an opening, up which a strong current of air is impelled, which prevents any of the grain passing down, but carries it upwards; the opening being into a large casing, from which the air escapes diagonally at the opposite corner, the grain is merely thrown over a low inclined partition, forming one side of the air inlet aperture; while the lighter particles of dust and other extraneous matter are carried still higher, and thrown over another inclined partition, thereby effectually cleaning and freeing the grain from dirt.

The current of air is produced by an exhausting fan placed in the egress channel from the separating case, the chambers for receiving the grain and dirt being, of course, quite close, to prevent the admission of air otherwise than at the proper point; the shoot on which the grain is received from the machine is furnished with a hinged flap which rests on the grain and prevents air being drawn through the machine.

In order to regulate the current of air, a partition is hinged at the bottom of the separating case, so as to incline in any position, and thus contract the upper part of the casing from which the air is drawn, as before explained; the inclined surfaces, over the upper edges of which the grain and dirt are severally carried, are also adjustable in their height; the lower one, which is contiguous to the inlet air aperture, is so constructed as at the same time to contract or extend this opening.

What the patentee claims with regard to this, the first part of his invention, is:—

First. The covering of the cylinders of grain-cleaning machines with a fabric composed of angular bars of iron, held together by strips of sheet metal, interlaced therewith, and set at suitable distances apart, as explained.

Secondly. The arrangement for regulating the current of air in grain-cleaning machines, as explained.

The second part of this invention relates to improvements in the machinery for dressing meal or flour, by which the operation is greatly accelerated; and which consists in the application of an exhausting apparatus to such machines, by which a more rapid passage of the flour through the wire-cloth is effected.

This improvement is shown in connection with the improved dressing-machine for which a patent was granted to William Ashby on the 25th of April, 1846; in which machine the dressing-cylinder is placed in a vertical position, and in which the flour is received on two surrounding shelves, placed on different levels; the upper shelf receiving the best, and the under seconds or worst, quality. In the surrounding casing which encloses the cylinder a vertical opening is found leading into a channel, at the top of which an exhaust-fan is situated; this receives motion from the brush-shaft, which causes air to enter the cylinder, and, passing through the meshes of the wire-cloth, carries the particles of flour along with it; but, immediately escaping, this flour remains no longer subject to the agitation which before held it in suspension, and, from its specific gravity, falls on the receiving-shelf, from which it is removed in the ordinary manner, while the air passes up through the exhaust apparatus. The exhaust-passage is so constructed that any flour partially carried upwards returns on its inclined surface to the receiving-shelf.

In the application of this principle to the ordinary flour-dressing machines, where the cylinders are placed in an inclined position, the patentee adapts a brushing apparatus to the interior of the cylinder, for the purpose of brushing out the coagulated portions of the flour adhering to the meshes. This apparatus consists of a series of brushes, each fastened by a stem similar to the handle of the ordinary paint-brush to a bar parallel to, and on, the exterior of the cylinder, from which the brushes project so as to pass between the circumferential ribs of the cylinder, between which the brushes have room for a little movement in the direction of the length of the cylinder. The bar to which the brushes are affixed is connected at one end to a bell-crank; the opposite arm is in connection with a small crank driven from the brush-shaft, so as to impart to the brushes a rapid reciprocating movement, which causes them to traverse across the space between the ribs; the cylinder itself, having a slow rotating movement imparted to it, brings the whole surface under the action of the brushes. The brush-bar is so fitted in its bearings that the brushes, on coming in contact with the longitudinal ribs, cant the bar, and slip over such bars without detriment to the brushes.

A train of wheels fitted on stud-pins to the fixed plates at the end of the cylinder reduces the motion given to it; the first of this train gears with the brush-shaft, and is the driver of the reciprocating brushes, as explained.

The claims for this part are:—

First. The application to machines for dressing meal or flour of an exhausting apparatus, whereby the air which enters the dressing-cylinder, or bolting-cloth, may be drawn out at the periphery thereof, for the purpose before explained.

Secondly. Giving traverse motion in the line of the dressing-cylinder's axis to the external brushes of meal or flour dressing machines, for the purpose set forth.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING APRIL 19TH, 1849.

Charles Alexander Broquette, of Rue Neuve St. Nicholas, St. Martin, in the Republic of France, chemist, for improvements in printing and dyeing fibrous and other materials. Patent dated April 21st, 1849; six months.

William Kilner, of Sheffield, in the county of York, engraver, for improvements in manufacturing railway and other axles and wheels, and in machinery to be employed in such manufacture. Patent dated April 24th, 1849; six months.

Lewis Vernet, of Buenos Ayres, for a method of preserving from destruction by worms, insects, decay, and fire, certain vegetable and animal substances. Patent dated April 24th, 1849; six months.

Thomas Harcourt Thompson, of Blackheath-hill, civil engineer, for certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places; and in apparatus and machinery for regulating the levels of waters in rivers, reservoirs, and canals. Patent dated April 26th, 1849; six months.

George Simpson, of Newington-butts, chemist, and Thomas Forster, of Streatham, manufacturer, for improvements in manufacturing or treating solvents of indiarubber, and of other gums or substances. Patent dated April 26th, 1849; six months.

John Barsham, of Chelmsford, in the county of Essex, manufacturer, for improvements in separating the fibre from cocoa-nut husks. Patent dated April 26th, 1849; six months.

Charles Iles, of Bordesley Works, Birmingham, machinist, for improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces. Patent dated April 26th, 1849; six months.

William Fauleonbridge, of Long-lane, Bermondsey, in the county of Surrey, for improvements in the manufacture of hose-pipes, driving-bands, and valves for atmospheric railways. Patent dated April 26th, 1849; six months.

Bartholomew Benjowski, of Bow-street, Covent-garden, major in the late Polish army, for improvements in the apparatus for, and process of, printing. Patent dated April 26th, 1849; six months.

Robert Oxland, of Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. Patent dated April 26th, 1849; six months.

William Henry Burke, of Tottenham, manufacturer, for improvements in the manufacture of airproof and waterproof fabrics; and in the preparation of caoutchouc and gutta percha, either alone or in combination with other materials, the same being applicable to articles of wearing apparel, bands, straps, and other similar useful purposes. Patent dated April 26th, 1849; six months.

John Horsley, of Ryde, in the Isle of Wight, practical chemist, for certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable purposes. Patent dated April 26th, 1849; six months.

Alphonse Garnier, late of Paris, in the Republic of France, but now of South-street, Finsbury, merchant, for certain improvements in extracting and preparing colouring matter from orchil. Patent dated April 26th, 1849; six months.—(Communication.)

James Wilson, of Old Bond-street, tailor, for improvements in trusses. Patent dated May 1st, 1849; six months.

James Godfrey Wilson, of Millman's-row, Chelsea, engineer, for certain improvements in the manufacture of glass, and in machinery and apparatus connected therewith. Patent dated May 1st, 1849; six months.

Alexander Munkiltritch, of Manchester, merchant, for an improved composition of matter, which is applicable as a substitute for oil, for the lubrication of machinery, and for other purposes. Patent dated May 1st, 1849; six months.—(Communication.)

John Dalton, of Hollingworth, in the county of Chester, calico-printer, for a certain improvement, or certain improvements, in printing

calicos and other surfaces. Patent dated May 1st, 1849 ; six months.

Samson Waller, of Bradford, in the county of York, manufacturer, for certain improvements in machinery or apparatus for weaving. Patent dated May 3d, 1849 ; six months.

Thomas Wentworth Buller, of Sussex-gardens, Hyde-park, Esq., for improvements in the manufacture of earthenware. Patent dated May 3d, 1849 ; six months.

Matthew Kennedy, of Manchester, cotton-spinner, for certain improvements in the method of packing "cops" of cotton, and other fibrous materials, and in the apparatus connected therewith. Patent dated May 3d, 1849 ; six months.

Thomas Whaley, of Chorley, in the county of Lancaster, coal-proprietor, and Richard Ashton Lightoller, of the same place, cotton-spinner, for certain improvements in machinery or apparatus for manufacturing bricks and tiles. Patent dated May 3d, 1849 ; six months.

PATENTS RECENTLY EXPIRED.

J. Stevenson and J. Ruthven, Edinburgh, for a method of cutting wood by certain improved instruments. Patent dated April 28th, 1835 ; expired April 28th, 1849.

C. W. Rowley, Kensington, engineer, for certain improvements in boilers applicable to steam-engines, and other purposes. Patent dated April 28th, 1835 ; expired April 28th, 1849.

W. S. Potter, Middlesex, merchant, for certain improvements for rendering fabrics waterproof. Patent dated April 28th, 1835 ; expired April 28th, 1849.—(Communication.)

J. S. C. Minister, Edinburgh, for certain improvements in the construction of guns or muskets, and other fircarms. Patent dated April 28th, 1835 ; expired April 28th, 1849.

J. Dodds, Stafford, engineer, for certain improvements in the construction of firearms, parts of which improvements may be applied in the making and using of cannon and other ordnance. Patent dated April 30th, 1835 ; expired April 30th, 1849.

Apothecaries'-hall.—The following are the names of the gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, the 3d of May :—Thomas Mudge, Bodmin, Cornwall ; George Anthony Kinsopp Lake, Devonshire ; Daniel Rossiter, Frome, Somerset ; George Down, Pimlico.

City Commissioners of Sewers.—On Tuesday, May 1, a court was held, over which Mr. Deputy Peacock presided. The City and the Chartered Gas Companies proposed a reduced scale of charges for lighting ; the proposition was received with applause, and Mr. Deputy Harrison moved that their offers be accepted, which motion was seconded by Mr. Deputy Cook, and unanimously agreed to. Mr. Deputy Godson said the commissioners and the public had to thank the Great Central Gas Company for the reduction, such as it was, and he had no doubt they would have to thank that company for still further reduction. The court then adjourned. It is understood that this reduction will not at all affect the intention with regard to the new bill, which will be most vigorously prosecuted next session.

Flexible Ivory.—It has been long known that, in subjecting bones to the action of hydrochloric acid, the phosphate of lime, which forms one of their component parts, is extracted. Bones preserved in this manner retain their original form, and acquire great flexibility. It is by this process that M. Charriere, a skilful maker of surgical instruments in Paris, softens the ivory of which he makes use to manufacture flexible tubes, probes, and other instruments. These pieces, after receiving the required form and polish, are steeped either entirely or partially in acid diluted with water, where they remain as long as required. The ivory, after having undergone this preparation, becomes supple, flexible, elastic, and assumes rather a yellowish colour. In the course of drying it again becomes hard and flexible ; but the flexibility of the ivory may be restored by wetting, either by surrounding it with a piece of wet linen, or by placing sponge in the cavities of the pieces. Some pieces of ivory have been kept in a flexible state in the acidulated water for eight days ; they were neither changed nor injured, nor too much softened ; they had acquired no taste, nor any disagreeable smell. With respect to the excellence of the articles thus manufactured by M. Charriere, it may be observed that they have been examined by competent judges, and approved of by the Royal Academy of Medicine. The preparation of flexible ivory may give rise to various useful applications of it in the arts or in manufactures.

Analysis of California Gold.—M. Rivot, mining engineer, has analyzed a specimen of California gold sent by Mr. Peabody to the Ecole des Mines. The specimen contained small flattened grains, of a fine yellow colour, and extremely small and smooth grains, attracted by the magnet, which appeared to be titaniferous iron. A rather large, yellow, and irregularly rounded grain, weighing 0.628 grs., the density of which was only 14.60, was fused on a small cupel in a muffle, and gave a button of alloy, the density of which was 17.48. The analysis of the grains of gold, performed on one gramme, gave the following results :—

Gold	90.70
Silver	8 80
Iron	0.38
	99.88

—*Annales des Mines.*

Manufacture of Porcelain.—The number of workmen employed to finish one article of chinaware is almost incredible ; a single cup is said (from the kneading of the paste) to pass through seventy hands before it is ready for sale ; each individual in its progress performing as little as he possibly can for the remuneration he receives. The Chinese decorate the exterior of their dwellings and their pleasure-grounds with enormous pieces of porcelain, both in the shape of vases and figures ; these are formed each in several pieces, and each piece or portion in a mould : the paste is first well pressed into the moulds, which are then placed before a fire for a short time, to detach the figures from their moulds ; the various portions are then united and cemented together, the joints are carefully smoothed off by the chisel, and are varnished and painted over, after which they are imperceptible. The designs traced upon their porcelain or china are very inferior, but the colours used by the artists who paint these designs are far superior to any European colouring. The division of labour in embellishing and painting the chinaware is equal to that employed in the formation of it : one traces figures, another flowers, a third paints the figures, and a fourth the flowers ; in fact, there is an artist for delineating and another for painting each particular object ; each goes on in one beaten track, without the least conception or attempt at improvement, or introducing new ideas in their designs ; and thus the same designs and figures are accurately copied by the artists of the present day which were in use in the days of Confucius. The most remarkable ware, however, is the kiasing, or azure-pressed ; the secret of its manufacture has been lost, but those specimens which are preserved are of inestimable value. The art was that of tracing figures on the china which are invisible until the vessel is filled with liquid. The porcelain is of the very thinnest description, almost as thin as an egg-shell ; it is said that the application in tracing these figures was internal, and not by external painting, as in ordinary manfacture, and that after such tracing was made, and when it became perfectly dry, a very thin covering or coating was laid over it of the same paste of which the vessel had been formed, and thus the painting lay between two coatings of chinaware. When the internal coatings became sufficiently dry they oiled it over, and shortly after placed it in a mould, and scraped the exterior of the vessel as thin as possible without penetrating to the painting, and then baked it in the oven. It is evident that if such be the mode which was adopted it would require the nicest dexterity and patient care, for which the Chinese are remarkable ; but, although they constantly endeavour to recover the exact method, their trials have been unavailing.

TO CORRESPONDENTS.

☞ The publication of Mr. Pyke's letter is unavoidably postponed till next week.

"W. J. P."—Lindley's "Introduction to Botany" will answer your purpose best. Wilson's translation of Jussieu's system was published by the Sydenham Society. We think the British Association of Science will meet this year at Birmingham, towards the middle of next month.

"G. G., Bury St. Edmund's."—We are not aware that a new material for fining beer has been recently introduced.

"B. B. B."—Steep the gherkins in strong brine for a week ; pour the liquid off, boil it, and pour it boiling on the gherkins. Let it stand for twenty-four hours. Drain off the liquid (in a sieve). Put the gherkins into wide-mouthed bottles or jars ; fill them up with strong pickling vinegar, boiling hot, bung down immediately, and tie over with bladder. When cold, dip the corks into melted bottle wax. *Piccalilly* (*not*, as our correspondent calls it, *Piccadilloe*) is prepared of white cabbages sliced, cauliflowers pulled to pieces and scalded, radishes topped and tailed, French beans, celery in three-inch lengths, shoots of elder peeled, cluster of elder flowers unopened,—all salted for two or three days, and then mixed with apples and cucumbers sliced, and a large proportion of ginger, garlic, turmeric, long pepper, and mustard seed. To these ingredients is added the strongest vinegar that can be procured. The quantity of the vinegar should be just sufficient to float the ingredients.

"Mr. Walton, Greenwich."—Mouth glue is prepared as follows :—Take of the best cake glue any quantity you like ; dissolve it in a little water, add to the solution a small quantity of brown sugar, and some essence or juice of lemons ; pour the mess into greased moulds, and let it dry. When required for use the cakes are wetted with the tongue, and rubbed on the paper to be joined.

"R. T."—We do not know. Perhaps the secretary of the college will give you the desired information.

"M. Williams."—The price is reasonable.

"W. T. S."—We make it a rule never to interfere in disputes of the kind.

"B."—We have not heard of the discovery in question.

"Mr. Richards" is referred to No. 124.

"W."—Fownes' "Manual of Chemistry."

"X. Y. Z."—We beg to decline. The article is not suited for our pages.

"Mr. A. Taylor, Bristol."—Probably next week.

"Mr. Watt, Brompton."—Cabinet-makers' varnish is prepared as follows :—Take of pale shellac, 750 parts ; mastic, 64 parts ; alcohol of 90 Cent., 1,000 parts by measure. Dissolve in the cold, with the aid of frequent stirring. The solution is always muddy. It is employed without being filtered.

"Mr. Jonathan Hert, Liverpool."—We are afraid the article will not answer. There is too much of it already in the market.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

London : Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—May 12, 1849.

ORIGINAL SERIES.

ON BENZOLE: ITS NATURE AND UTILITY.

A LECTURE.

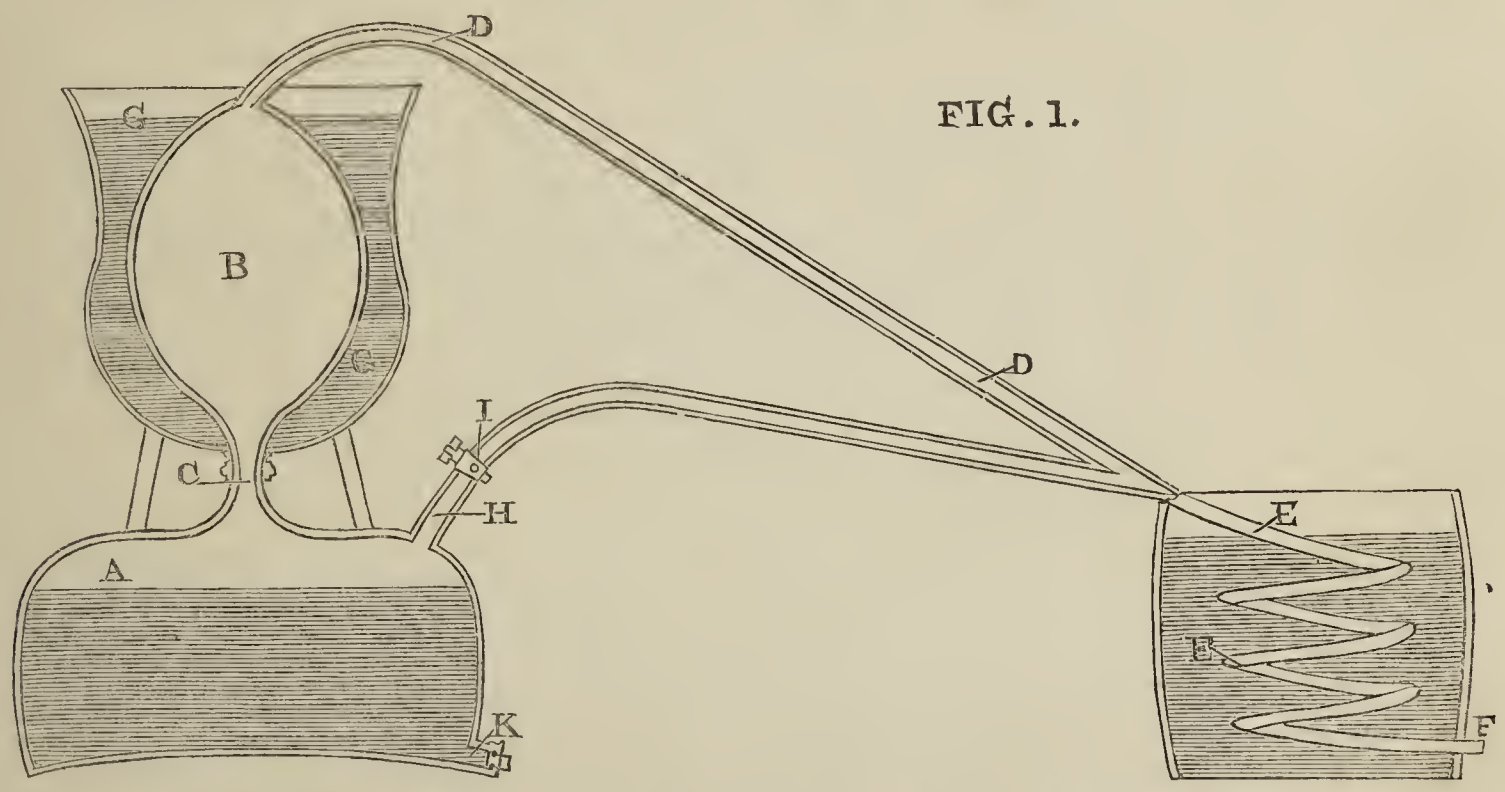
By C. B. MANSFIELD, Esq.

[*Continued from page* 363.]

I now come to the education of the benzole,—to the means by which it has been elevated from its degraded state in the tar to the dignity of a pure substance. Its presence in coal-tar was first detected by Dr. Hofmann four or five years ago; he discovered it by means of its convertibility into aniline, and by the remarkable test, to which I have already called your attention, by which aniline is recognised. I shall have occasion to return again to this interesting metamorphosis. I will only suggest to you at present that it is remarkable that this one alone, of all the immense number of hydrocarbons with which we are acquainted, has this property of producing the blue colour with hypochlorite of lime, after being subjected to the appropriate treatment; although many of them under the same circumstances undergo transformations closely similar to those suffered by benzole. Of course, since aniline already exists in coal-naphtha, it was necessary, before applying this test for benzole, to remove all the aniline from the oil; this was readily effected by shaking it with hydrochloric acid, which removes the aniline at once, by reason of its attachment for the acid.

Thus the presence of benzole in coal-tar was ascertained; but it was still an object of interest to determine whether it was there in any quantity, and what other hydrocarbons were with it. This could only be attained by a tedious series of rectifications, by which these oils were gradually separated from each other, and collected about the boiling points belonging to each of them. As the result of these experiments from a gallon of crude naphtha (of which from 5 to 10 per cent. is yielded by the tar) was obtained about a pint of each of these oils, benzole, toluole, cumole, and cymole, with a large quantity of naphthaline, and a small quantity of the alliaceous spirit above alluded to, while the rest consisted still of mixtures of two or more of these substances, which would require farther distillations to separate them. It thus appeared that benzole existed in considerable quantity in the naphtha; and this was found to be the case in every sample that was tried from many different localities. Its properties seemed to be so useful, and its capabilities of application so numerous, that it seemed worth while to attempt its separation by a compendious method. An apparatus was accordingly contrived, the principle of which is shown in the diagram, Fig 1. *A* is the

FIG. 1.



retort or boiler, which is charged with light coal-naphtha, from which the vapours, as they are evolved, are conducted into *B*, the head, through the neck *C*. *D* is a pipe which leads from the top of *B* to any convenient condenser, represented in the diagram by a still worm *E*; from the mouth of which, *F*, the benzole runs. *B* is enclosed below and on the sides in an outer vessel *G*, which is open above and nearly filled with water, which need not be changed during the operation. *H* is a secondary neck, through which the remainder of the naphtha, after the extrication of the benzole, may be distilled off, by turning on the tap, *I*. *K* a pipe for running off the tarry residue. You will remember the physical fact which opposes a difficulty to the isolation of volatile liquids from solution in each other: it is the family affinity which causes them to adhere together both in the liquid and in the aëriform state. Thus in coal-naphtha the benzole clings to the toluole and to its compatriot oils, which hold it back quiescently liquid, even when such heat is applied to the mixture as would be sufficeint to boil pure benzole rapidly into vapour; and not only this, but, when the benzole is forced away by the rising temperature, the more volatile oil carries away with it a portion of the toluole, which proves the strength of its affection by impairing the purity of its fellow product. The end to be attained, therefore, is the separate condensation of these other vapours which come over with the benzole, so as to allow, as far as possible, the benzole vapour alone to pass into the condenser.

Now, the boiling point of benzole is the same as that of spirit of wine, so that the conditions necessary for its rectification are to a great extent the same as those for the separation of the alcohol from the aqueous liquor from which it has to be distilled: accordingly, any still that is used for the rapid rectification of alcohol would serve equally well for the removal of the benzole from the naphtha. But there are these differences which render the purification of the benzole easier than the isolation of the alcohol. Both of these spirits are held in union with the liquids, from which they are to be severed, by the family force of solution. But between the alcohol and a certain quantity of water there is a still closer tie of friendship, which unites them into a compound analogous to a double salt—a hydrate, as it is called, of alcohol; this combination cannot be sundered by simple distillation, however often repeated. No such instance of affection, superadded to their family love, is known to occur between benzole and any of its cognate hydrocarbons. Again, the boiling point of the water from which we have to detach the alcohol is only 36° Fahr. (20° Cent.) higher than that of the spirit; while the benzole is diluted with oils, some of which boil only at temperatures more than 180° Fahr. above benzole, and the oil nearest to it in the series boils when pure 63° (Fahr.) above our point 176°; and not only are the distilling temperatures of the oils farther apart than those of alcohol and water, but in the interval between benzole and its nearest neighbour, toluole, the boiling point of water occurs. It is this fortunate intervention of this point between the epochs of ebullition of these two oils, which favours the rectification of benzole, and on which the contrivance of this still is founded.

It will be perceived that, when heat is applied to the retort *A*, the temperature of the charge of naphtha will gradually rise, till at last it boils; and that the vapour as it rises will come in contact with the cold inner surface of *B*, and will there be condensed. As this proceeds the drops that are here formed continually trickle down, and are returned into the retort; no vapour (except some permanent gases which had been held in solution in the naphtha) escaping into *D*. But every atom of vapour that is liquefied in *B* gives out heat (in obedience to the universal law that condensation produces heat, or expansive force,—the converse of the power from which it results), and thus the temperature of *B* will be gradually raised till it becomes hot enough to allow the vapour that is most difficult of condensation to pass over. Thus more and more vapour continually escapes above, and is conducted down into *E*, which is kept as cold as possible, and there it is liquefied. The temperature of the water surrounding *B* soon reaches nearly to the boiling point of benzole, which will therefore distil over rapidly, while so much of the toluole and oils having higher boiling points as are carried up into *B* with the benzole vapour are still almost entirely condensed, and returned into the retort; or, if required separately, into another receiver. The benzole continues to distil till the naphtha is exhausted of it, and the temperature of the water in *G* goes on rising till it actually boils. Now, at first sight you might suppose that the boiling water would heat the apparatus, so as to assist the naphtha vapour in escaping, if it did not compel it to pass on; but, on the contrary, the boiling of the water cools the vapour powerfully, and the faster it boils the more it condenses the vapour; or, the more the vapour is condensed the more it boils the water. Neither phenomenon is cause, and neither effect, neither is before or after the other; and, as in all instances of so-called causation,

not actually dynamical, we can only really understand the fact by reasoning in a logical circle. And now that the water boils, if the proportions of the parts of the still are properly adjusted, distillation will altogether cease at *F*; no liquid remains in the retort that has not a boiling point at least 25° above that of water; so as the vapour comes up into contact with the water vessel, it can do nothing but give up its heat to the water (which has a greater right to it, or, at any rate, a stronger power of taking it), and go back discomfited to whence it came.

The freedom of our produce of this operation from toluole and cumole will not be absolute, but it will approach more nearly to perfection according to the extent of cooling surface in the head, through whose ordeal the vapour has to pass. By this means we shall have obtained a material sufficiently volatile for many uses to which it is proposed to apply it. This crude benzole contains, however, some very volatile matters, which, being impurities, it is desirable to remove. Such are the alliaceous spirit, of which I have spoken as containing sulphur; picoline, an alkaloid analogous to aniline, and of a peculiarly foul odour; ammonia; and another substance, which has been called pyrrol, but which is only known by a property which it possesses. Aniline and carbolic acid come too late in the history of the ebullition to be mentionable among these early events. Pyrrol is supposed to be a gas. Taking it as a representative of the impurities (which are all removable from the benzole by one of the most convenient means by which we get rid of this one of them), we get a sort of test of the purity of our produce, and of its fitness for refined purposes. This I can make evident to you without resorting to the testimony of your olfactories. Here is a piece of common deal wood. I wash it over with the crude benzole, and then with hydrochloric acid. You will see that the wood rapidly acquires a deep purplish colour. With pure benzole no such reaction occurs. The abstraction of all these impurities from the benzole may be effected by mixing it with concentrated sulphuric acid, or by passing the spirit as it distils through that substance. Some other reagents will effect this purpose, but sulphuric acid is as cheap and as easy of application as any of them. Here are two bottles, each containing some oil of vitriol; into one I pour some benzole, crude as it comes from the still, into the other some of the same hydrocarbon purified. I shake the bottles, so as to mix their contents thoroughly; when they have been left a few seconds to settle, you will see that the acid in each bottle separates from the oil, which floats on it, refusing to fraternize. The acid that was with the crude material has become dark brown and opaque; the other remains clear and colourless. The impurities have all combined with the stranger acid; the benzole remains intact. The reserved demeanour of benzole in this respect is the more remarkable, as, among the neutral oils of the naphtha, not only is the very volatile alliaceous spirit carried off by the sulphuric acid, but the toluole, if it be present, will form a compound with this reagent, while benzole may be even boiled upon it with impunity. In this treatment the ammonia and picoline have formed, of course, as do all true alkaloids, real salts with their equivalents of the acid, which is so far neutralized. But it must be remembered that the compounds formed by the other (non-basic) substances with sulphuric acid are not salts; they have not in the least satisfied the electro-polar attachment of the acid, nor have they in any way diminished its capacity for conjugal union, though they have slightly weakened the strength of its affection. It is still acid; but in any saline alliance that it may hereafter form it is encumbered by the adherence of these bodies which it has adopted, and which it carries with it into combination, as parasites upon its natural vitality.

We have thus polished up, as it were, our benzole to a very reasonable degree of refinement. But even yet it is not a chemically pure substance. It still contains small quantities of the other hydrocarbons, from which, by simple distillation or by treatment with acid, it could only be freed after many repetitions of these processes. But it has a peculiar property by which it was first marked as a distinct substance by Mr. Faraday, by which it has been recognised whenever it has appeared, and which now gives ground for the final step in our process of preparation. It is its faculty of crystallizing at about the same temperature as that at which water solidifies. It is the only one of the hydrocarbons of coal-tar, almost, indeed, of the whole family, that, being liquid at common temperatures, will become solid at any temperature above 0° of Fahrenheit's scale. I here place in a mixture of ice and common salt test-tubes charged respectively with oil of turpentine, with common coal-naphtha, with each of the hydrocarbons of coal-naphtha (which are named on the tables), with benzole (a specimen made from benzoic acid, as well as one from coal-tar), and with water; and among them I place this small sealed tube containing a precious specimen of Mr. Faraday's oil, which has been preserved in it for nearly a quarter of a century. They are now exposed to a temperature some degrees below 32° Fahrenheit. A few seconds of exposure will be sufficient to show you the difference between benzole and its congeners. You will see as I remove the tubes from the freezing mixture that the benzole is the only one of the oils that is at all visibly affected. Each specimen of this substance, from three entirely different sources, has obeyed the law of its idea, and has crystallized; the water, too, is converted into ice. The specimen of coal-naphtha, though it contains benzole, is not apparently altered, for the affinity of the other oils retains our spirit in liquidity. It would require a much lower temperature to overcome this force of solution and to induce the benzole to crystallize from the mixture.

Here, then, is a ready means of purifying our substance. Nothing is necessary, when we have obtained it in approximate state of isolation, but to freeze it, and to subject the solid result to pressure, which will free it from the liquid oil with which it may be mixed. Here is a very convenient apparatus for the purpose, one of Beart's coffee-filters. It has been filled with the benzole as it is obtained by distillation from the still which I just now described, and has been placed in a freezing mixture, in which it has remained a sufficient length of time to have solidified a great part of its contents. Here is a further quantity of solid benzole in test-tubes. You will see that the crystalline mass is readily expelled from the tubes by warming the closed end with the hand: by this means a small portion of the substance is converted into vapour, which expanding drives out the remainder, which fits the tube like a piston. I place all my solid produce in the coffee-pot, and draw up the filter. You see the beautiful snowlike mass I obtain. By pressing this further with considerable force in a syringe, with a perforated bottom covered with cloth, till all liquid is squeezed out, then screwing off the bottom of the syringe, I press down the plug which pushes out this solid lump of pure benzole. This substance now is perfectly pure. It will be found to have a constantly boiling point at 176° Fahr. (80° C.). Its education is now completed; and I hope to be able to show you that this has not been done in vain, but that benzole is capable of offering some really profitable services to the community.

The most obvious quality of this liquid, that which belongs in a greater or less degree to every member of the order of hydrocarbons, is its inflammability; this at once suggests the question of its suitability to the purposes of a fuel for light or for heat. The inflammability of any substance depends directly upon its convertibility into gas, either by simple evaporation or by decomposition. It will be interesting to compare benzole in this respect with another of the liquid hydrocarbons existing in coal-naphtha. Here are two small dishes: into one I pour some cumole, into another benzole; into each I dip a lighted match; you will observe that the cumole extinguishes the flame, while the benzole takes fire on the surface, before the flame of the match reaches it. Benzole is, therefore, more inflammable than cumole, and this precisely because it is more volatile: the air in contact with it is filled with its vapour, which kindles on the approach of the burning wood. The cumole, however, is inflammable when exposed to heat sufficient to evaporate a portion of it; this match, after having been dipped in cumole, readily takes fire at a candle. Here is a camphine-lamp charged with this oil; it burns as brilliantly as oil of turpentine, and can be obtained at a much lower price; the objection to the use of purified coal-naphtha in these lamps has been that it is too inflammable, giving off vapour in too great quantity. Coal-naphtha owes this property chiefly to the benzole which it contains; so that the separation of the benzole from this material actually increases the value of the residue—the skimmed milk of the oil. Let us, however, examine whether the cream of our naphtha can be turned to the account which it seems to promise. Its volatility would seem to indicate that it may serve as a source of portable gas, as a fuel for a lamp in which the liquid is converted into gas by the heat of its own combustion, so as to be burned without any wick exposed to the flame. Here is a small arrangement which will illustrate its capabilities in this respect; it is a thin brass tube, about three inches in length, and a quarter of an inch in diameter, enclosing a cotton wick, and closed at the upper end with a small cap, with several fine holes perforated round its crown, forming a set of jets by which the vapour of any volatile liquid in the wick, being heated, may escape. I soak the wick in benzole, and pass the lower end of the wick and tube through a cork into a bottle containing a fluid ounce of benzole. It now forms a sort of temporary lamp for our experiment. I heat the little burner; the vapour escapes from the holes, and takes fire; the heat of the combustion will keep up the supply of gas. You will see at once that the volumes of dense smoke which it evolves negative its applicability as a source of light in this manner. It contains far too much carbon to be burned in this way with advantage. It is found by experiment that the proper proportions of carbon and hydrogen for a light fuel to be burned in the open air are those of an equal number of equivalents of these elements. This is the constitution of olefiant gas, which is the chief source of the light from our common coal-gas. If there be any considerable excess of either element above this standard some special contrivance is necessary to effect perfectly luminous combustion. Now, the composition of benzole (H_6 C_{12}), containing twice as many atoms of carbon as of hydrogen, explains the copious evolution of soot in its combustion, and states for us numerically the amount of difficulty to be contended with. It is clear, however, that, if we can mix with the vapour of the benzole another vapour or gas containing less carbon, without increasing the actual quantity of material passing out for combustion in a given time, we can, by a proper adjustment of the mixture, obtain a perfect practical imitation of olefiant gas. Here is another little lamp-burner, exactly the same as that which I just now charged with benzole. I saturate the wick with alcohol, and place it for supply in a bottle containing two fluid ounces of that spirit. On heating it and igniting the vapour I obtain a gas-lamp of no illuminating utility: it yields only a pale blue flame. Alcohol, then, contains too little carbon. I now mix the contents of my two bottles, and moisten the wick of this third little tube, the exact fellow of the other two, with the mixture. You see that I now obtain a perfectly luminous flame, equally free from smoke and from unprofitable blueness.

Here is a large lamp which has been charged with a mixture of benzole and wood-spirit, in proportions the same as those, which I just now took, of the hydrocarbon and spirit of wine.

You will see that it yields a no less brilliant light.

This dilution of the hydrocarbon vapour may be equally effected by means of permanent gases. Here is a pipe leading from a reservoir of carbonic oxide; here another from one of hydrogen. The gas issuing from the first, you see, burns with a clear blue flame; that from the second with a pale greenish one; both equally useless as means of light. I now pass each of these tubes through a perforated cork into a bottle containing benzole; from each bottle another tube rises, through which the gas can escape, after passing in contact with the liquid, and by which it is conducted to a gas-burner. On allowing the gases to pass, and lighting them as they issue from the jets, I obtain large bodies of highly luminous flame. These gases, in the state in which they have been here prepared in the laboratory, are far too expensive to be used as common fuel; however, a mixture of them may be very cheaply obtained by passing steam over red-hot coke. Gas prepared in this way, and "naphthalized" with benzole, may, by reason of the ready volatility of the hydrocarbon, be conducted through pipes and burned like common coal-gas at any distance from the vessel in which the benzole is evaporated.

But there is yet a cheaper gas than this steam-gas—atmospheric air. Perhaps we may find that it, too, will act as the vehicle of our vapour; let us examine its behaviour with our benzole as compared with other evaporable liquids. Here is a regiment of twelve test-tubes, each containing a small quantity of a different volatile liquid; each tube is closed with a cork, through which pass two pipes, one dipping into the liquid, the other simply opening from the upper part of the tube into the air; by this latter air driven through the test-tube will escape, and may be examined as to its inflammability. Of the other pipes the outer end of each is connected by a flexible tube with another tube passing through the cork of a wide-mouthed bottle; all the twelve passing through separate holes in the one cork, and dipping below into some mercury. Another tube passes through this large cork, and just opens into the bottle, its other end being in connection with a gasholder filled with air. Now, when the air is allowed to press through this last pipe, there will be no farther passage for it till one of the other twelve tubes is drawn up so as to lift its lower end above the mercury in the bottle; but when any one of these is raised a current of air will be established through the corresponding test-tube; and this will be stopped when the tube is pushed down again into the mercury. Let us try all the liquids in order. I apply a lighted match to the pipe leading from each test-tube, and, at the same time, I admit the air to pass through it. 1st. Alcohol; no visible flame; or only a pale blue fringe to the flame of my match, which disappears on the removal of the latter. 2d. Pyroxylic spirit; a small, pale, bluish flame, which, however, disappears on the withdrawal of the lighter. 3d. Bisulphide of carbon; a clear blue flame, yielding no white light. 4th. Ether; a voluminous bluish flame, fringed and tipped with yellowish white, not luminous to any useful extent. 5th. Chloroform; not a trace of ignition; but the flame of the match is coloured, where the vapour touches it, purplish-blue. 6th. Acetone; a bluish flame, with a yellow tip, similar to that of ether, but smaller. All these were very volatile liquids, equally with, or more than, benzole, but not containing so much carbon. The next six are less volatile, but do not differ very much from benzole in carbon-content; these last are all hydrocarbons. 7th. Then oil of turpentine; not a vestige of flame. 8th. Common coal-naphtha; a small flame with a white tip, but chiefly blue. All the rest are oils separated from coal-naphtha by careful rectification. 9th. Cymole; no flame, nor any sign of ignition. 10th. Cumole; no flame whatever. 11th. Toluole; a pale blue flame, which goes out when the match is moved away. 12th. Benzole; a large, brilliant, white flame. Benzole, then, is the only one of these common liquids which combines the two qualities, volatility and carbon-in-composition, in the degree adequate to the purpose, which is here illustrated in an embryo form (the small quantity of white light from the common coal-naphtha was due to the benzole it contains); and this experiment is sufficient to show you that it possesses both these requisites in a very remarkable degree, so much so that here again, as in its power of crystallizing, it stands out as it were, even among its own group, as the typical genius of the family.

[*To be continued.*]

ON THE INFLUENCE OF SOLAR RADIATIONS.

A Lecture Delivered at the Royal Institution, April 21,

By ROBERT HUNT, Esq.,
Author of "Researches on Light," Keeper of the Mining Records, &c.

ACTINIC, LUMINOUS, CALORIFIC RAYS—INFLUENCE OF LIGHT ON COMPOUND BODIES—INFLUENCE OF LIGHT ON VEGETATION—INJURIOUS EFFECTS OF THE CALORIC RAYS ON PLANTS IN CONSERVATORIES.

Few of the discoveries of science are surrounded with that general interest which attaches to the productions of impressions of objects by the agency of solar radiations. The subject has received considerable attention from the scientific world during the last ten years, and many hypotheses have been advanced to account for the wonderful phenomena which have grown upon our knowledge. Nevertheless, I am bound to state my conviction, that no true theory of the influence of solar radiations has as yet been given to the world. The results observed in one direction, however so well they may agree with the theories by which it is attempted to explain them, are at variance with other theories which prevail in a different department of the same study. At the same time, I must also state that I am prepared with no theory of my own; my object, at present, being merely to set forth the science as far as it is at present known, and to present this audience with some of the results I have obtained.

To start from chloride of silver. If into a solution of nitrate of silver we pour hydrochloric acid, or a solution of any of its salts, a white curdy precipitate falls, which is chloride of silver. The chloride of silver precipitated in this way (by means of common salt, for instance), and carefully washed to remove every trace of nitrate which may adhere to it, will, upon exposure to the rays of the sun, be found after a time to darken slowly, and pass from white through pale blue to grey, and eventually to olive-green, and, if any organic matter be present, to black. These changes of colour are owing to the separation of chlorine. If we allow the action of the solar rays to go on under water, we find that chlorine is liberated by the action of the sun upon the salt. So again, if we take iodide of silver, prepared by precipitating solution of nitrate of silver with iodide of potassium, and washing the salt from all adhering matters, this (the iodide) will, upon the slightest addition of nitrate of silver, blacken much more readily than the chloride. In the first of these cases we have a change produced by the separation of silver and chlorine. An oxide of silver is certainly formed, but this oxide is itself reduced by the action of light, and we obtain the metallic silver in a remarkably fine state of division. In gaslight, or in the dark, chloride of silver will preserve its whiteness; but in the sunshine it inevitably darkens. If we allow a pencil of light to enter a dark room through a hole in the shutter, and to traverse a paper prepared with one of the salts named, the line of the solar ray will be marked by a dark line. This circumstance appears to warrant the name which has been given to a certain class of phenomena, under which the interesting pictures called "photographic" are included, since, in the first instance, all appears to be the work of a luminous ray, and no effect is produced in the dark. We use optical instruments in these operations: the camera obscura, and all the circumstances and appliances wherewith we surround ourselves, remind us of luminous agency. Nevertheless, one of the points impressed on my mind most deeply is, that in these cases the photographic effect is produced by other agency than that of light. At all events, the photographic phenomena are distinct from the luminous phenomena of the solar ray. In order that all the phenomena connected with the chemical changes produced under the influence of the sun's rays may be clearly understood, it will be necessary to explain the peculiar constitution (as far as it is known) of the sun's beam. This is the more necessary, as the relative intensity of effect is according to the superficial colour of the object from which the light radiates.

Most persons are familiar with the fact that the beam of white light is a compound of certain colours. This is demonstrated by passing a pencil of the sun's rays through a prism, by which it is bent out of its direct path; and, having to pass through unequal thicknesses of the glass, a separation of the several rays is effected: indeed, an analysis of the beam of white light is made. Sir Isaac Newton—who was the first philosopher who measured these rays, and from the examination of them propounded the theory of light and colour which bears his name—regarded white light as a compound of seven different rays, which, according to the order of their refrangibility, are red, orange, yellow, green, blue, indigo, and violet. Sir David Brewster has, however, proved, by analyzing the white beam of light by means of coloured absorptive media, that this beam, in fact, consists of only three primitive colours—red, yellow, and blue, all the other varieties of colour being produced by a mixture of these three. Sir John Herschel has shown that there exist two classes of coloured rays at either hand of the Newtonian spectrum, which are only visible under certain conditions. If we look at the ordinary spectrum through a cobalt-blue glass, we find that below the red ray a ray of crimson hue has become visible. This Sir John Herschel has termed the extreme red ray. If we project the coloured spectrum upon a piece of turmeric paper, we find that, beyond the violet ray, a ray of peculiar colour—called by its discoverer the "lavender" ray—is apparent. According to our present knowledge, therefore, the solar ray has a constitution such as is represented by the following diagram, in which it is attempted to show to which particular class of the three primitive colours the prime secondary rays belong:—

Lavender	Blue.
Violet.....	
Indigo	
Blue	
Green...	Yellow.
Yellow	
Orange	
Red.....	Red.
Extreme Red	

It must, however, be distinctly understood that no line of demarcation exists between these rays; they are all (so to speak) interblended with each other; even in the red ray some blue is detected; and the violet of the most refrangible rays is due to a mixture of the red rays with the blue. It does appear to me that in this spectrum we have a doubling of one spectrum upon another; that the primitive spectrum, or wave, as it is called in the language of the undulatory theory, only extends from the red to the indigo; that from the central point (near yellow), which is the main luminous point, where the maximum of luminous power resides, there is a gradual diminution of light till we pass through the green into the blue, and arrive at indigo, which is the darkest point in the luminous range.

It was first observed by the alchemists that chloride of silver was blackened by the sun's

rays, and Scheele discovered that this blackening was due to the violet rays of the spectrum. Ritter proved the existence of rays possessing chemical action far beyond that of the visible rays, and which were accordingly called chemical rays, and also "Ritter's invisible rays." The whole question remained, however, without any satisfactory elucidation till within the present century; indeed, until since the discovery of Daguerré. Sir William Herschel and Sir Henry Englefield had ascertained that the maximum calorific effect of the sunbeam resided in the red or, rather, in the extreme red, rays, and that the thermic influence gradually diminished with the increased refrangibility of the rays, until it ceased to be measurable at the extreme limit of the violet. Sir William Herschel also determined in a very satisfactory manner that the maximum of luminous power resided in the mean yellow ray, from which point it gradually diminished toward either end of the prismatic image. If we allow a well-defined prismatic spectrum to fall upon a daguerreotype-plate, we shall find that the impression made by the rays will differ with each preparation. We hence infer that there is a scale of action constant for each chemical combination, but varying according to the force of affinity exerted between the elements of the compound, or, rather, the stability of chemical equilibrium. Thus, on a paper coated with the nitrate of silver in solution, the violet rays alone act. On chloride of silver, the violet, indigo, and blue rays act with equal intensity, and a chemical power is manifested far beyond the visible limits of even the lavender rays. On the bromide of silver this action is still more extensive; and on the iodide of silver, washed over with gallic acid, or with a solution of protosulphate of iron, the chemical excitation is exerted over every part of the spectrum, excepting the maximum point of luminous power, even beyond the visible limits of the spectral image at its least, as well as at its most, refrangible extremity. From the numerous experiments that have been made within the last few years, we are now enabled to determine with considerable accuracy the minimum and maximum points of chemical, luminous, and calorific power in the solar rays. They exert two maximum points of chemical action, one much inferior to the other, but only one maximum of calorific action, or of luminous influence. The rays of chemical action are respectively opposite, indigo and red. The heating rays of the sunbeam have been traced far below the limits of the visible rays, and the influence which causes chemical change is exerted over a far more extensive space, extending from below the extreme red ray to a point beyond the violet ray, to the entire length of the visible spectrum. From a consideration of these facts we come to the conclusion that the amount of heat communicated to the earth by the solar radiations is nearly double the quantity of light we receive, and that the principle or force on which the chemical photographical changes we have to consider depend exists in the sunbeam much more extensively than heat or light, regarding those terms in their ordinary acceptation.

This chemical force is, indeed, exerted over a space where there is no light, and ceases at that point where the greatest luminous influence is evident, from which it has been inferred that in all photographic phenomena we have to deal with a principle which is broadly distinguishable from both light and heat, and for which the term actinism or ray power has been suggested, and to a considerable extent adopted. The points and centres for the remarkable phenomena of light, heat, and actinism are thus found to be widely separated from each other in the solar beam. The greatest heat is exerted at a point beyond all luminous action, but it extends—only diminishing in power—through all the luminous rays; and we may trace some curious relations between the thermic influence of these rays and the calorific properties of bodies of a corresponding colour. In the red rays the greatest heat prevails; we always associate an idea of warmth with a red colour, and red transparent bodies both transmit and reflect large quantities of heat. Light, regarded merely as the agent of vision and colour, is confined within narrower limits than heat.

Such is the definition as regards the colours of the spectrum as we now consider them. Now, if we take this spectrum, and throw it on a paper which has been prepared with chloride of silver, the effect produced does not agree with the quantity of light found in the spectrum. When a paper prepared with tartrate of silver is used, the yellow ray, in which the luminous principle most prominently exists, not only produces no active effect, but screens the object on which it falls from the action of the actinic principle. One more point must here be noticed. At the end of the spectrum, where we expect to find the greatest intensity of thermical action, there exists a spot entirely protected from the action of diffused light when this is made to fall on paper prepared with chloride of silver.

Proceeding now to some of the photographic effects of the solar rays on compound bodies, we shall commence with the chloride of silver. The spectrum impressed upon a paper spread with the chloride of silver is often very beautifully tinted, the intensity of the colours varying very considerably with the kind of muriate used. Papers prepared with the hydrochlorate of ammonia, or of baryta, and then with two successive washes of the nitrate of silver, have given me (when the sunshine has been favourable) a range of colours very nearly corresponding with the natural hues of the prismatic spectrum. Under favourable circumstances, the mean red ray leaves a red impression upon the paper, which passes into green over the space occupied by the yellow rays. Above this a leaden-blue is discovered, and about the mean blue ray, where the action is greatest, it rapidly passes through brown into black, and through the most refrangible rays it gradually declines into a bluish-brown, which tint is continued through the invisible rays. At the least refrangible end of the spectrum the very remarkable phenomenon has been observed of the extreme red rays exerting a protecting influence, and preserving the paper from that change which it would otherwise undergo under the influence of the depressed light which always surrounds the spectrum. It appears to me that not only the extreme red ray exerts this peculiar property, but the ordinary ray throughout the whole length. If we throw a beam of solar light upon a paper prepared with the nitrate of silver instead of with the chloride, the colour of the impressed spectrum is at first pale brown, which passes slowly into a deeper shade, that portion corresponding with the blue rays becoming a blue-brown, and under the violet of a peculiar pinky shade. I have sometimes observed a very decided green tint on the point which corresponds with the least refrangible rays. The total length of the spectrum impressed on white paper, as well as the gradations of its most refracted end, will admit of measurement in about eighty-five parts. Its limit of action is very near the centre of the yellow ray, and its maximum appears about the centre of the blue, although the action up to the edge of the violet ray is continued with very little diminution of effect; beyond this point the action is feeble. Tartrate of silver, whether prepared from pure tartaric acid, from the tartrate of potass, cream of tartar, or Rochelle salt, appears at first to change but very slowly under the influence of solar emanations; but, after a short period, the darkening process is much accelerated, and the paper prepared with this salt assumes a much higher degree of blackness than paper prepared with almost any other of the preparations of silver. Sir John Herschel experimented with paper prepared with solutions of the tartrate. The spectrum impressed upon this paper commenced at, or a little below, the mean yellow ray, of a delicate lead colour, but faint and dilute; and, when the action was arrested soon after the first impression was made, such was the character of the whole photographic spectrum. But, if the light was allowed to continue its action, there was observed to come suddenly a new, and much more intense, impression of darkness, confined to the blue and violet rays; and, what is more remarkable, confined also in breadth to the middle of the sun's image, so far, at least, as to leave a border of the lead-coloured spectrum traceable, not only round the clear and well-defined convexity of the dark interior spectrum at the least refrangible end, but also laterally along both its edges. And this border was the more easily traced, and less liable to be mistaken, by reason of its singular contrast in colour with the interior spectrum. That of the former was lead-grey, of the latter an extremely rich, deep velvety brown. If paper washed with the tartrate of silver is allowed to darken slightly, and then washed over with a weak solution of the iodide of potassium, the darkening process proceeds with great rapidity, and a most intense blackness results.

If a paper prepared with the tartrate of silver is washed over, before exposure, with a solution of iodide of potassium, its sensibility is much increased; and we find, by exposing such a paper to the prismatic spectrum, that a very different image is impressed. The impression does not descend below the green ray of the spectrum, but at that point a delicate blue or grey colour is impressed. It rapidly darkens, and throughout the whole of the most refrangible rays a very intense blackness is produced, which penetrates very deeply into the paper. The darkening process is carried on for a very considerable space beyond the last visible violet ray, but with greatly diminished intensity. The least refrangible rays do not appear to act at all, or, if they act, they assist simply in converting the whole of the tartrate into iodide of silver. We do not find any of those protected spaces in this spectrum which are observed in the photographic image received on the pure tartrate paper. Bromide of silver does not appear to be very readily changed by the solar rays when it is perfectly pure. The slightest admixture of the nitrate of silver renders it very susceptible of change. As soon as the prismatic spectrum falls upon paper prepared with this salt, it blackens over the whole extent of action with nearly equal intensity. The maximum effect, which is not easily detected, from the rapidity of the action, appears to be produced somewhere about the indigo rays. Its most striking peculiarity is its exceeding length. Instead of terminating at the mean yellow ray, or thereabout, the darkened portion extends down to the very extremity of the visible red rays. In tint it is pretty uniform (a grey-black, not by any means intense) over the whole length, except that a slight tinge of redness is perceptible at the least refracted end. By allowing the nitrate of silver to be in excess, the grey-black may be very much darkened. Below the red ray an extended space is protected from the agency of the dispersed light, and its whiteness maintained.

These are only a few of the instances by which the universal fact is illustrated that the solar rays are continually acting upon and modifying matter. Although, for purposes of photography, we can only select those compounds which exist, as it were, in a state of equilibrium, ready to be destroyed by the slightest disturbing cause, yet we have distinct evidence that a sunbeam cannot fall upon any solid body without leaving permanent traces of its action.

Light, we have already seen, although connected with, is a power not only independent of, but even antagonistic to, the power which produces chemical change, so far as the solar radiations are concerned. The yellow glass that we interpose between an object and light scarcely obstructs the passage of light at all, while a blue glass obstructs it most. If, then, the popular notion, that it is the light, as such, which produces photographic effects, were correct, it would follow, as a matter of course, that you would get a better photographic copy of an object with the interposition of yellow than with that of a blue glass.

The frame placed on the table before me contains a large daguerreotype portrait; it is glazed with half blue and half yellow glass. You cannot see through the blue as you can through the yellow, and yet it is under the blue glass that the copy is best obtained, while under a yellow glass it cannot be taken. Thus, as I have shown, the power or force which enables us to take these copies cannot be light, since, in that case, yellow, in which most luminosity resides, would be the most favourable colour for taking them. The belief has passed current for these fifty years that by a mixture of the component colours of light as found by prismatic analysis we can get white light. Although this statement has been repeated in books and lectures times without number, I do not hesitate to say that up to this time a mixture of blue, red, and yellow, has never given white light.

There are some curious facts connected with the influence of light on vegetation which claim notice here. It is well known that light—the light of the solar ray—is essential to the healthful growth of plants, but, when we examine the various conditions of the solar ray, we find that different kinds of solar radiations are necessary at different seasons of the year. Starting from germination, we know that if we place a seed in a warm moist position, and exclude light, chemical action is set up, starch is transformed into sugar or dextrine, which, being soluble, are fitted to convey nourishment to all parts of the plant; in a short time vitality becomes manifest, little elevations are thrown up, and the plant begins to grow. It is also well known that the process of malting is always carried on in a dark, shady locality; the process of malting will not go on in the sunshine. Now, we have the very curious fact that under the influence of the solar rays seeds will not germinate. All seeds that germinate do so in the dark. If upon a seed placed under conditions otherwise favourable to germination we throw a ray of light which has been robbed of the chemical principle (the principle which produces photographic images), the seed will not germinate. On the other hand, if the actinic radiations are separated as much as possible from the luminous rays, which may easily be done, germination is accelerated, and takes place at a greater depth in the soil than when the full sunlight exerts its influence. I have made some experiments which place this fact in a very clear light. I provided a box, the slanting lid of which was composed, half of blue glass, and half of yellow glass. In this box, containing suitable mould, I sowed seeds of cress. Now, as the seeds were placed under precisely the same conditions, except in respect of the simple relation of light and actinism, it must be obvious that any marked variation in the phenomena observed must be attributable to the power of one or both of these forces. The result was that under the blue glass, permeated by the actinic, but not by the luminous, ray, germination went on rapidly, while in the part of the box placed under the yellow glass, a glass admitting much light, but no chemical principle, no appearances were presented above ground, although on removing the soil some very slight indications of germination were detected, probably attributable to some small portion of chemical power, which had contrived to pass, perhaps, by favour of some defect in the glass. If we place seeds in earth screened from the immediate action of light by the intervention of a bottle containing a solution of bichromate of potash, to which a small quantity of oil of vitriol has been added, the actinic rays will then be abstracted from the solar beams, and only luminous rays will pass. In this case, also, seeds will not germinate. But, after the leaves have once developed themselves, the requirements of the plant become altered, and the luminous more essential than the actinic rays. Of course the blue glasses will not now have the same healthful effect, and the yellow glasses, admitting more light, will be more appropriate. The necessities of the plant demand the decomposition of the carbonic acid of the atmosphere, the secretion of woody fibre to form the structional arrangement of the plant. It was formerly imagined that carbonic acid was decomposed more readily under the influence of the radiations transmitted through blue glasses, that is the actinic radiations, than by any other; but this, the opinion of Saussure, has been shown to be a mistake. When we take vegetable matter (*e.g.*, cut leaves) and place it in tubes exposed to the action of water charged with carbonic acid, and subject the tubes to the rays of the spectrum, the carbonic acid is decomposed more rapidly under the blue than under any other ray. But if we take the vegetable in its perfect organic state, not cut or mutilated, decomposition of the carbonic acid takes place much quicker under the yellow ray than under any other. Light decomposes, we thus find, more carbonic acid than actinism. This, I think, appears to be due to some functions of vitality, some susceptibility peculiar to the plant in a living state. Mattucci has shown by a beautiful experiment that the mere wounding the leaf modifies (diminishes) this power of the leaf to decompose carbonic acid in the light, and proved that the quantities decomposed when the part of the plant is separated, and when united to the parent organization, are different.

It is found that when the plant has arrived at maturity, and the development of the reproductive functions commences, the least refrangible or calorific rays become most active, and contribute powerfully to the formation of fruits and flowers. Thus, by artificial means, we are enabled to imitate Nature, and easily produce the circumstances which, with the change of the seasons, are essential to the various stages of vegetable life. Another remarkable instance of the effect of light on vegetation is seen in the manner in which it influences the colours of plants. Plants growing in the dark become etiolated, having white stems and yellow leaves; but when brought into sunshine they acquire their natural green colour. Dr. Gardner, of New York, assumed that the green colouring principle of plants, called "chlorophyle," was formed solely under the influence of the luminous rays, and that plants grown in the dark had a tendency, when exposed to the influence of the prismatic rays, to bend out of the line of rays at either end towards the mean yellow or maximum luminous ray; but in this Dr. Gardner was mistaken. It has long been known that plants bend towards the light, and the experiments of many philosophers have shown that the tendency has been more strongly exhibited towards the blue ray than towards any other. Now, it has since been found, by experiments made in this country, that plants bend from the red or heating rays; and, perhaps, it was the observation of these two actions that led Dr. Gardner to believe he had detected a lateral motion of the rays of light. By bringing etiolated plants under the influence of a large spectrum, they become green under the green and blue rays, before any change has been produced by the other rays. It is thus rendered probable that the production of chlorophyle is due to the joint influence of heat and actinism.

It has been found that plants growing in stovehouses often suffer from the scorching influence of the sun's rays. Especially has this been the case since the introduction of German sheet glass into conservatories. Many of the most delicate exotics at Kew have had their leaves burnt in a very remarkable manner. From the enormous size of the new Palm-house at Kew, those contrivances, such as blinds, &c., by which it has been attempted to cut off this destructive calorific influence, were out of the question. It was, therefore, thought desirable to ascertain whether it would be possible to cut off these scorching rays by means of a tinted glass which should not be objectionable in appearance; and the question was, at the recommendation of Sir William Hooper, submitted to me by the Commissioners of Woods and Forests. The object was to select a glass which should not permit those heat rays which are the most active in scorching the leaves of the plants to permeate it. By a series of experiments made with the coloured pieces of glass on the palms themselves, it was ascertained that the rays which destroyed their colour belonged to a class situated at that end of the prismatic spectrum which exhibited the greatest calorific power, and just beyond the limits of the visible red ray. A great number of specimens of glass were submitted to examination, and it was at length ascertained that glass tinted green appeared likely to effect the object most readily. Some of the green glasses which were examined obstructed nearly all the heat rays; but this was not desired; and these, from their dark colour, were objectionable, as stopping the passage of a considerable body of light.

Every sample of glass was submitted to three distinct sets of experiments:—1. To ascertain, by measuring off the coloured rays of the spectrum, its permeability to the luminous influence. 2. To ascertain the amount of obstruction offered to the chemical rays. 3. To measure the amount of heat radiation which permeated each specimen.

The chemical changes were tried on chloride of silver, and on papers stained with the green colouring matter of the palms themselves. The calorific influence was ascertained by a method employed by Sir John Herschel in his experiments on solar radiations. Tissue paper stretched on a frame was smoked on one side by holding it over a smoky flame, and then, while the spectrum was thrown upon it, the other surface was washed with strong sulphuric ether. The points of calorific action were ascertained by the evaporation of the ether as those points dried off in well-defined circles, before the other parts presented any appearance of dryness. In this way it was not difficult, with care, to ascertain with great exactness the conditions of the glass as to its permeability to light, heat, and actinism. The glass chosen was of a very pale yellow-green colour, the colour being given by the oxide of copper: this glass is so transparent that scarcely any light is intercepted. In examining the spectral ray through it, it is found that the yellow is slightly diminished in intensity, and that the extent of the red ray is affected in a small degree; the lower edge of the ordinary red ray being cut off by it. It does not appear to act in any way upon the chemical principle, as spectral impressions obtained on chloride of silver are the same in extent and character as those procured by the action of the rays which have permeated ordinary white glass. This glass has, however, a very remarkable action upon the non-luminous heat rays—the least refrangible calorific rays. It prevents the passage of all that class of heat rays which exists below and in the point fixed by Sir William Herschel, Sir H. Englefield, and Sir John Herschel, as the point of maximum calorific action. As it is to this class of rays that the scorching influence is due, there is every reason to believe that the use of this glass will be effectual in protecting the plants; and at the same time that it is not objectionable in colour, and transparent to that degree which is necessary for the development of those parts of the plant which depend upon external chemical excitation, it is only partially permeable to the heat rays, and opaque only to those rays which are most injurious. The total absence of the oxide of manganese commonly found in all sheet glass is an indispensable condition here; it having been found that glass into the composition of which manganese enters will, after exposure for a time to intense sunlight, turn to a pinky hue; and any tint of this character would completely destroy all the peculiar properties for which this glass is chosen.

Samuel Wilkes, of Wednesfield-heath, near Wolverhampton, brassfounder, for improvements in the manufacture of knobs, handles, and spindles for the same, for doors and other purposes; and improvements in locks. Patent dated May 8th, 1849; six months.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LVI.

(LECTURE LXXXIV.)

SAPONIN—(*Concluded*).

ASPARAGUS.

We use the roots and the young shoots of asparagus (Asparagus officinalis).

The roots of asparagus are considered to possess diuretic properties. They are mostly given in infusion at the dose of 30 grammes per quart of water. The root of asparagus forms one of the so-called five aperient roots.

According to M. Dulong d'Astafort's analysis, the root of asparagus contains:—

Vegetable albumen,
Gummous matter,
Resin,
Saccharine matter,
Bimalate, hydrochlorate, acetate, and phosphate of potass and of lime,
Bitter extractive.

Although the analysis does not mention saponin among the constituents of the root, the presence of this principle appears to me highly probable. I rest my opinion on this point upon the botanic relationship which exists between sarsaparella and asparagus, and also upon the fact that Walz has found a matter analogous to saponin in the Paris quadrifolia, a plant which belongs to one and the same family with asparagus.

EXTRACT OF ASPARAGUS ROOTS.

Take of Fresh asparagus, any quantity you like.

Pick and wash the asparagus carefully. Pound, and add to the bruised mass sufficient water to cover it completely; subject to the action of the press, strain through the bolting-cloth, and evaporate on plates, in the stove.

This process is by M. Vaudin. M. Gendrin has found the extract prepared after this formula very effective as a diuretic.

From 10 kilogrammes of fresh asparagus I obtained 830 grammes of an extract of pilular consistence.

The young shoots of asparagus contain, according to Robiquet's analysis:—

Chlorophyle,
Asparagin,
Vegetable albumen,
A viscous resin of acrid taste,
A starch-like substance,
Extractive,
Colouring matter,
Acetate and phosphate of potass,
Phosphate of lime.

Asparagin is a principle which has been found since in other plants besides asparagus. It contains a large proportion of nitrogen. It is colourless and inodorous; and has a cool but nauseous taste. It crystallizes in prisms and octahedrons. It is not over-soluble in water, and altogether insoluble in alcohol. It is neither acid nor alkaline. Upon ebullition in pure water, or under the influence of alkaline matters, asparagin is converted into ammonia and a peculiar acid (aspartic acid).

The medicinal properties of asparagus juice seem to be altogether independent of the asparagin.

EXTRACT OF ASPARAGUS TOPS.

Take of hot clarified Asparagus juice, any quantity you like. Evaporate at a gentle heat.

The juice of asparagus furnishes from four to five per cent. of its own weight of extract.

SYRUP OF ASPARAGUS TOPS.

Take of Asparagus tops, any quantity you like.
White sugar, a sufficiency.

Remove the whole of the white part of the asparagus. Pound the green portion, and express the juice. Heat the expressed juice in order to coagulate the albumen which it contains. Strain through the bolting-cloth. Add to the strained liquid double its weight of sugar, and make a syrup by simple solution.

This concludes the chapter on Saponin. Next week we shall commence that on the Vegeto-Alkalis.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE NEUTRAL SULPHATE OF THE OXIDE OF ETHYLE AND THE PRODUCTS OF ITS DECOMPOSITION.

By Dr. CHARLES M. WETHERILL.

Although the neutral sulphate of the oxide of ethyle, the true sulphuric ether, has been sought for in vain, and doubtless often formed, Dr. Wetherill has first succeeded in isolating it and studying its properties. It is prepared by slowly passing the vapours of anhydrous sulphuric acid into pure ether surrounded by ice and salt; agitating the mixture with 1 vol. ether and 4 vols. water, separating the two strata of liquids, agitating the ethereal solution with milk of lime, washing with water, and distilling off the ether. The oily liquid in the retort is transferred to a capsule, washed with a little water, and dried *in vacuo* over oil of vitriol. The aqueous solution contains sulphurous, ethionic, and sulphovinic acids; and, if the temperature were not kept low, it contains in addition isethionic and methionic acids.

When pure, the neutral sulphate is a colourless oily liquid, of a pungent taste and peppermint odour; spec. grav. 1.12; distils with great difficulty, even in an atmosphere of carbonic acid; the distillate is colourless, neutral, and heavier than water. Chlorine is dissolved by it in the cold without decomposition, giving a green colour, and the oil is again precipitated by water. A solution of potash, saturated with sulphuretted hydrogen, changes it into mercaptan and sulphate of potash:—

$C_4H_5O, SO_3 + KS, HS = C_4H_5S, HS + KO, SO_3$.

It dissolves without alteration in fuming nitric acid; but by adding potash, and heating, nitrous ether is formed (C_4H_5O, NO_3). Treated with muriatic acid and potash, a heavy oil distils over with an odour of apples. With water the oil disappears entirely, leaving an acid solution. The carbon and hydrogen were determined by combustion with oxide of copper, with chromate of lead, and with a mixture of oxide of copper and chlorate of potash; the sulphuric acid by chloride of barium. The result was C_4H_5O, SO_3.

By the action of water aided by heat the oil entirely disappears; and, if carbonate of baryta be added and the filtered solution be evaporated, crystals of methionate of baryta separate, and the remainder of this salt is thrown down by alcohol. The methionate is proved by its properties and analysis. The mother liquor yields a salt soluble in alcohol, which is shown to be an equal mixture of sulphovinate and isethionate of baryta by analysis and behaviour; for sulphovinic acid is resolved by boiling into sulphuric acid and alcohol, while the latter is not. By determining the baryta in the mixture, boiling the acids, removing the free acid by carbonate of baryta, and determining the baryta in the last solution of isethionate, the weight of the former is found to be about double that of the latter.

It follows from these experiments that the usual explanation of the formation of heavy oil of wine, previous to that of ethionic acid, is erroneous, for not the slightest trace of the heavy oil of wine is found in the substance resulting from the action of anhydrous sulphuric acid on ether or alcohol. The probable rationale is, that the anhydrous sulphuric acid partly forms directly the neutral sulphate of ether (C_4H_5O, SO_3), and partly decomposes the ether, forming Regnault's sulphate of olefiant gas ($4SO_3, C_4H_4$), which takes up 1 equiv. water to form ethionic acid ($4SO_3, C_4H_5O$). Another portion of the acid takes up water and unites with ether, producing sulphovinic acid ($C_4H_5O, 2SO_3, HO$). In the case of alcohol, part of the sulphuric acid takes up water and unites with a portion of alcohol, forming hydrated sulphovinic acid, while the liberated ether partly forms the neutral sulphate and partly ethionic acid. The products of decomposition sufficiently distinguish the neutral sulphate from the heavy oil of wine. 4 equivs. of the neutral sulphate, with 3 equivs. water, are first resolved into ethionic acid and 3 equivs. alcohol, and by the action of heat into isethionic and sulphovinic acids and alcohol, as shown in the following equation:—

$4(C_4HO, SO_3) + 3HO = C_4H_5O, 4SO_3 + 3(C_4H_5O, HO) = C_4H_5O, 2SO_3 + C_4H_5O, HO, 2SO_3 + 2(C_4H_5O, HO)$.

—*Proc. of Amer. Phil. Soc.*, No. 41.

ON THE AMOUNT OF AMMONIA CONTAINED IN THE ATMOSPHERE.

By M. FRESENIUS.

The presence of small quantities of ammonia in the atmosphere has been placed beyond doubt by the experiments of Scheele, De Saussure, Colard de Martigny, Faraday, W. Zimmermann, Brandes, Chevalier, and Liebig. Nevertheless science as yet possesses but very uncertain data relatively to the proportions in which this alkali is mixed with the atmosphere. To be satisfied of this, it suffices to compare the results of two analyses made on this subject by M. Gräger and Dr. G. Kemp. The first sought to determine the quantity of ammonia contained in the atmosphere by passing 1.112 cubic metres of air through weak hydrochloric acid, evaporating the acid liquid after the addition of some bichloride of platinum, and weighing the residue of ammonio-chloride of platinum after suitable washing with alcohol containing ether. He found by this process 1,000,000 grms. of air to contain 0.323 grm. of ammonia = 0.938 carbonate of ammonia.

This determination is probably not free from error, M. Gräger having neglected to determine the quantity of ammonia which might be contained in the reagents themselves. The same must be said of the determination made by Dr. Kemp, by passing through a solution of corrosive sublimate air collected 300 feet above the Irish Sea. When the experiment was finished, the mercurial solution was boiled, and the white precipitate obtained, to which Dr. Kemp assigns the formula ($HgCl + 2HgO + HgNH_2$), was weighed. According to this experiment, 1,000,000 grms. of air contain 3.68 grms. of ammonia = 10.37 grms. carbonate of ammonia, *i.e.*, eleven times the quantity stated by M. Gräger. The question is evidently far from being solved by these experiments; it, however, deserves a very careful investigation, on account of the very important part ascribed to atmospheric ammonia in vegetation. These considerations induced the author to undertake some experiments on the subject, which were made in the following manner:—To aspire the air the author employed two large gasometers, each capable of containing 10,000 cubic centimetres; they were in action alternately day and night. The air which they aspired was received through a long tube above the house of M. Fresenius at Wiesbaden, which is situated on an elevation at one extremity of the town. The air, before entering the gasometer, had to pass through a small condensing apparatus, formed of two small balloons connected with each other and filled with dilute hydrochloric acid. The acid was prepared by mixing 1 part of pure acid of 1.12 sp. gr. and 20 parts water. Every morning during forty days one of these condensing apparatus was set in communication with a gasometer filled with water, which in the course of the day flowed into the other empty gasometer. This worked in its turn during the night with another condensing apparatus, and emptied itself into the first gasometer. In this manner the quantities of ammonia contained in the air, both during the day and during

the night, were collected separately. In the month of August, 1848, 218,650 cubic centimetres traversed one of the apparatus during the day, and 217,050 cubic centimetres passed through the other apparatus during the night. During the month of September, 126,600 cubic centimetres of air passed through during the day, and 127,200 during the night.

When this operation was concluded the contents of each condensing apparatus were poured into a porcelain capsule, care being taken to rinse the apparatus with a sufficient quantity of distilled water. The contents of the capsule, mixed with 4 grms. of a dilute solution of chloride of platinum, were evaporated to dryness on the water-bath. The residue was exhausted with a mixture of 2 vols. concentrated alcohol and 1 vol. of ether, which removed the excess of chloride of platinum. There remained after this treatment a minute quantity of ammonio-chloride of platinum, which was collected and washed with a mixture of alcohol and ether upon a small filter of Swedish paper, the weight of which had been carefully determined; the salt was then decomposed by heat, the filter incinerated, and the residue, consisting of metallic platinum and the ash of the filter, weighed. At the same time the amount of ammonia contained in the reagents, in the hydrochloric acid, water, and chloride of platinum, was carefully determined. Care was taken to use exactly the same quantities as had been taken for the experiments. The filtering paper left 0.0011 ash for 0.2487 grm. of paper.

The following are the numbers given by M. Fresenius:—

a. The reagents furnished:—

Platinum and ash	0.00270
The filter weighed 0.2004, and should have yielded ash	0.00088
Platinum =	0.00182

b. The air which passed during the day gave:—

Platinum and ash	0.00270
Ash	0.00064
Platinum =	0.00206

c. The air which passed during the night gave:—

Platinum and ash	0.00290
Ash	0.00067
Platinum =	0.00223

Now, if we deduct the amount of platinum found in *a* from those found in *b* and *c*, we have:—

For *b*	0.00024	platinum.
For *c*	0.00041	"

According to which 1,000,000 grms. of air contain during the day 0.098 grm. of ammonia = 0.283 carbonate of ammonia. During the night the same amount of air contains 0.169 ammonia = 0.474 carbonate of ammonia.

These experiments have but one fault—the quantity of ammonio-chloride of platinum collected is much too small. A slight error in the weighing, or in the determination of the ash, or a minute loss, might exert an enormous influence on the results. The author, therefore, considers that it is requisite to undertake further experiments on the subject upon a larger scale; in the meantime, the preceding data may serve as an approximation.—*Journ. de Pharm. et de Chim.*, April, 1849, and *Chem. Gaz.*

METHOD OF OBTAINING COPPER AND SILVER IN THE MOST MINUTE STATE OF DIVISION.—A solution of sulphate of copper is heated to the boiling point, and precipitated with distilled zinc. The precipitated copper is then separated from the adherent zinc by means of dilute sulphuric acid, and dried by exposure to a moderate temperature. From recently-precipitated chloride of silver an exceedingly fine silver dust may also be obtained by boiling it with water acidulated with sulphuric acid and zinc.—*Boetger.*

THE CHEMICAL TIMES.

SATURDAY, MAY 19, 1849.

THE CRUSADE OF THE HALL AND THE MEDICAL PROTECTION SOCIETY AGAINST CHEMISTS AND DRUGGISTS.

WE publish this day Mr. Pyke's fourth letter on the *famous*, or rather *infamous*, cases of persecution got up against Dr. Lobo and Mr. Wells, by a body of men who, in the printed report of their proceedings, style themselves "respectable," and have even the charming assurance to append "Esq." to their names, but who seem to have no repugnance to do the dirty work of spies and informers "for a consideration." We publish, also, two letters from another valued correspondent of ours which throw considerable light on the nature and objects of this precious "Medical *Protection* Society," and on the character of its *members*, or rather *numbers*, for, with the true bashfulness of great minds, they have thought fit to adopt the Penitentiary plan of going by *numbers* instead of *names*, which plan, it must be confessed, cannot but tend to facilitate considerably the operations of the "informer's department."

It would appear that it was at first the "intention" of this precious society to proceed, indiscriminately, against any member of the medical profession *not* a licentiate of Apothecaries'-hall. This plan was, however, too grossly absurd to be persevered in. Mr. Pyke has clearly shown that any attempt against a member of any of the universities, colleges, or other chartered institutions of Great Britain and Ireland, must of necessity prove a most lamentable and disgraceful failure; and the master and wardens of the hall are rather too wide awake to become the cat's-paw where nothing but *live coals* can be gathered, although they have no objection to officiate as the monkey where *chesnuts* may be got at. It has been accordingly determined to leave the physicians and surgeons alone, and to confine the range of operations to the body of chemists and druggists, with occasional onslaughts on such holders of foreign diplomas as may happen to be "poor in purse, and timid in mind;" and it would appear from certain hints dropped at one of the meetings of the Protection Society that the authorities of the hall have consented to a fair division of the spoils (should any such be got in the intended crusade); which, considering how much the money is wanted by themselves, is exceedingly handsome of them, and well deserving of the "return courtesy" of their worthy allies, who, on *their* part, undertake to bear the whole of the expenses, no matter which way County Court wisdom may incline the scales.

Whether Mr. Pyke's letters may not, perchance, have the effect to sever the *brotherly* alliance between Rhubarb-hall and the "*numbered gentry*" remains to be seen. We have a notion that the "master and wardens" will deem discretion the better part of valour, and speedily leave their allies in the lurch. As it is, however, within the range of probability that the hall will persevere in the intention to have "a try for it," it behoves the threatened body of chemists and druggists to prepare for the strife. We, therefore, call upon the members of that body most earnestly and urgently to combine at once, and to raise, by subscription, *ample* funds to vigorously defend any action that may in future be brought against any of them by the Medical Protection Society and its allies of the hall. Should County Court wisdom decide in favour of the prosecution, let the matter be carried at once before a higher court, and, St. Paul's to a farthing rushlight, "Counsellor" Griffits's law will be found to cut a very sorry figure indeed.

MISCELLANEOUS CORRESPONDENCE.

APOTHECARIES'-HALL v. LOBO, M.D. OF GIESSEN.

APOTHECARIES'-HALL v. WELLS.

"Walls have ears."
Basil Montague, Esq., Q.C.

"Fat scraps and dainty bits
Make rich the ribs,
But banter out the wits!
Oh! Rhubarb Hall!
Thy rotten buttresses are giving way!"

How odd if the stale and effete City Company of "Seriveners" were once more to raise its head and make a similar attack upon the barristers, solicitors, attorneys, equity pleaders, common law pleaders, Crown draughtsmen, parliamentary agents, conveyancers, and notaries, as the Apothecaries' City Trading Company are now doing, or threatening to do, and will hereafter "try" to do, upon the physicians, surgeons (of different grades), foreign diplomas, chemists, Irish and Scotch graduates, &c. And why not? Prithee, where is the difference of the assumed ridiculous right in principle, and where will it all end? How singular that "real" quacks should remain unscathed, yea, untouched!

"Mr. Corrie: What gang? The Apothecaries' Company?—Witness: No; not them."—*Vide Trial in re Wells.*

"Law in its 'present' state, like orthodoxy in religion, is a mystery where reason ends and faith begins: none of the uninitiated can enter even the vestibule of the temple. Law ought not to be a branch merely, but the chief branch, of social ethics. Society knows nothing about it but by means of the lawyer. A digested code of plain, undeniable legal principles, founded on the morality of common sense, applied to every day's transaction, might render the whole community wiser, better, more prudent, more cautious, less litigious. Men would be better able to judge where they ought and where they ought not to go to law. They would be better jurors, arbitrators, wiser and better citizens."—*Cooper.*

What prevents the general body of apothecaries in England and Wales from at once combining, and, by a commanding yet pithy bill in Chancery (at the instance of any one of their body on behalf of the rest), praying for a discovery of rents, issues, and profits, against "the tradesmen," with prayer for appointment of a good scheme for medical benefit on high public and professional grounds?

"A good cause receives more injury from a weak defence than from a frivolous accusation."—*Andrew Marvel.*

"Mr. Sergeant Heath asked the learned counsel if he was quite sure that the County Court had jurisdiction in the matter, as he (Sergeant Heath) was not quite sure on that head."—Vide *Apothecaries'-hall v. Lobo, M.D., of Giessen.*

"The right of chemists to dispense prescriptions is too serious a matter for the County Court to adjudicate upon."—*Per Mr. Sergeant Heath in re Apothecaries' Company v. Wells*, tried April 19, 1849, verdict for defendant "with costs."

Quære? Just so! Therefore how much more serious when the distinguished rights of the universities of Great Britain and Ireland are attacked in the persons of their medical graduates (not to mention foreign diplomas), by the miserable dregs of 1813?

[To the Editor of the Chemical Times.]

Sir,—City corporation systems (*i.e.*, trading or shopkeeping companies) are famed in ancient story for "gastric power," and it must be conceded that the grand aim, even to the present hour, is to "keep up the funds for glorious feed divine." All centres here, by which abuse perpetuates, and both truth and principle ply in vain.

Has the plan of Hudson, the railway king, been copied from the hall? Has capital been trenched upon to keep up the price of shares? Why the late commotion amongst the three hundred and odd shareholders, headed by that radical reformer, Mr. C——, and the increase of dividends to the extent of one third, in fact one half; also the withdrawal of the presents of plate, and the promise of future open inspection

of accounts, more particularly with regard to the expenses for dinners, committees, &c.; the promised abandonment of the "in and in" senility and imbecility plan of election, and the infusion of younger blood from the general body of the 300 and odd? But mark, not beyond those: to the general body of L.A.C.'s the door is still to be closed. Reform is still a sealed book in that matter.

Has not the treasury of the company been encroached upon, and have not the creature comforts of the select been considerably reduced to keep up the fifteen or sixteen per cent. dividend? Has it not been found necessary, in order to recruit the finances, and to keep the shareholders in good humour, that penalties and examination fees should be made to increase?

Tradesmen of Water-lane, Shoemaker's-row, and Puddledock, answer this! And, again, allow me to ask, do not the examination fees and the penalties (if received) go to swell the "corpus" of your trust estate, out of which your alleged shareholders are paid their heavy dividend? And has it not been necessary to apply "the screw" of late for these objects, and on the plan named?

Now, for another serious, and allow me to add "uprooting," question. Pray tell us by what power, and by what authority, can the hall persevere in its present system of election to honours, and also to the direction, a system which excludes the general body of L.A.C.'s (I mean those beyond the 300 and odd shareholders), not only from voting in the election, &c., "but also from any share in the profits"? The granting of an L.A.C.'s certificate, rely upon it, gives something more than a mere name. It is a question worth battling for by the general body, and, if they take my advice, they will at once combine, and fight for it. Let them subscribe to a decent tune, and work the question up to the House of Lords, if necessary; and, if an appeal to that assembly should fail, why, then destroy the system by a short parliamentary act. It requires but the will, and the business is done. If the physicians and surgeons would join in the work, the ridiculous usurped rights of the tradesmen would be settled in a trice, and the apothecary then, and not till then, become a professional man.*

Mark me, there is no alternative. Apothecaries'-hall by its own acts has shown that it is either a public trust held for the general body of the profession at large, and its whole estate available for all alike, or it is a mere "wholesale drug-shop," that has taken advantage of the universal ignorance, and, relying upon that ignorance, has assumed a power not only foreign to its nature, but incompatible with every principle of law and equity that must and ought to pervade and regulate a high public trust. And so soon as corporation reform commences in the city of London, so soon will Apothecaries'-hall, with its trading character and assumed rights, cease to be, unless the wholesale and growing indignation of the learned professions at the present county-court actions, so injurious in their character, shall in the mean time succeed to sweep its anomaly from amongst us.

There is not a clear-headed and deep-thinking lawyer in England who, on surveying "the whole rotten fabric" I have portrayed, and bared to the view in my several letters, will not feel shocked that a distinguished profession should be so disgracefully placed as the medical profession is at this moment. A noble theme for social progress indeed! Alas the reflection; and now the subject of "pettifogging slime to riot on"!!!

Forbid it justice! Forbid it truth! Forbid it! But why do I say forbid it? No. Go on then, mystery of iniquity. *Quem deus vult perdere, prius dementat.* He whom God desires to destroy he first deprives of his reason. *Multis minatur qui uni facit injuriam.* He who injures one threatens a hundred. The storm gathers; it requires but direction, and the "system" must fall; for against the system alone are my four letters distinctly and solely levelled.

The most fell enemy of "this shopkeepers' company" will have his desire gratified, viz., see it engaged in a few tough lawsuits; without the ability to discern the vortex, with no friend to give the advice of Lord Chief Justice Willes (viz.), "That he who would go to law must have a good cause, a good purse, a good attorney, a good advocate, good evidence, and a good judge and jury, and, even having all these goods, unless he have good luck too he will stand but a bad chance of success."

Now for the second action, that against Wells, and its "righteous verdict." The medical journals should perpetuate this action and its results in every way.

I beg leave here to call universal attention to the witness O'Reilly's evidence, viz., "I called with Mr. Eyre, the solicitor for the plaintiffs, to 'caution!' the defendant about practising." Now, if any future defendant should be similarly favoured let him take this advice, "keep his mouth shut," and instantly call in two witnesses, and dot down upon paper everything that takes place on the part of "the lawyer and his helper," and send me the facts duly authenticated; and be sure to identify the person or persons who may call upon this errand, and to ascertain their name and address. Don't forget this advice. Remember matters have now come to a "foot to foot contest."

The defence of Mr. Wells, the chemist, deserves, indeed, to be perpetuated as a guide for the courts and for reference. The masterly points taken at the trial on the "28th clause," and also the tradesmen's letter to the committee of chemists in 1813, are of unmistakeable value, and good and sound lawyers will make them of "telling import" hereafter. This point even shook the wisdom of the County Court, and drew forth this truly valuable dictum from its head, "The right to dispense is too serious a matter for the County Court to adjudicate upon." Indeed! Then how much more serious and important to venture to decide upon the rights of the universities, colleges, hospitals, and institutes of Great Britain and Ireland, from whence physicians and surgeons derive their status, diplomas, and rights to practise, &c. &c. &c., under various charters, acts of Parliament, and various decisions at common law upon the statutes of the universities that can and will be pleaded the first moment any one of their medical members are touched by the tradesmen, who are already fervently and cordially hated by the universities. Have the trading company the "pluck" to bring another action against a member of either Oxford or Cambridge holding a medical degree from either university; or against a Scotch or Irish graduate?

How would the "tradesmen" fare? If the university were to put out its long crushing iron arm and grasp against the company, by claiming sole cognizance under its statutes, before which Westminster-hall itself is compelled to bend, and carrying the cause to the "Apodyterium" or "Hall of Justice"—the Stone Star Chamber say of Oxford, for instance — the scene would be rich, indeed; but to the "trading shareholders" frightful in the extreme. I think I see Dr. M'Bride (if alive), Dr. Bliss, and Messrs. Hughes and Company, the proctors, at work upon "the drug-shop." Would his Royal Highness the Prince Albert, or his Grace the Duke of Wellington, permit the "intrusion" without annihilating the company, if appealed to on the subject; and would not both the Crown and Parliament be put in motion, to wipe out the stain? And this view applies to every other "public" foundation thus interfered with through any one of its members "elsewhere." Rhubarb-hall would be reduced to positive powder on the attempt, "so intense is the hatred of university men against anything savouring of trade," and the "gross insult" would never be forgotten, but only obliterated by the utter destruction of the company, and its absurd pretensions. Ignorance alone has hitherto saved the hall; but this is now, I trust, dispelled by these letters. Blackstone says, "The universities enjoy the sole jurisdiction, in exclusion of the King's courts, 'over all civil actions and suits whatsoever in which a scholar and privileged person is one of the parties.'"

I have stated the above law with regard to university and college men as one instance merely. The attempt at even a bare outline of any given defence, either on the Crown or civil side of the common law, applicable to any one action, "is no criterion or safe guide for another," and for this reason:—

"So multifarious are the degrees, lines, and departments of practice in the medical world, adopted by its many professors, under the heads of 'Physician, Surgeon, &c.;' and so divers and multifarious are the rights of the universities, colleges, hospitals, and institutes, built upon charters of the early Kings and Queens of Great Britain and Ireland, (charters infinitely more ancient than the 'Grocers' or 'Barbers'), that may be infringed in the prosecution of any one of their members; and also the rights and privileges of several foreign institutes in England, and the rights delegated to the embassies of foreign powers in Great Britain, who can create and give authority to whom they please to practise, and to throw themselves under the protection of the Foreign Ambassador, on the plea of being attached to his suite; and finally, so numerous are the principles of law that may govern one case and not affect another, that it will be at once perceived that the trading company has, indeed, fallen into a positive 'sea of trouble;' and must, in self-defence, sooner or later, 'if well hammered at,' give up its object in despair;—so ruinous, so hopeless, so troublesome, so damaging, and calamitous will the attempt prove to raise its shareholding dividend income from drugs and law at the expense of the public bodies, interests, and laws above named."

By these more than mad proceedings (against Lobo and Wells) the shareholders have brought upon themselves universal detestation, and have, moreover, opened the eyes of the large body of L.A.C.'s to their rights.

To show the iniquity of the present proceedings, no one case of real quackery (as commonly understood) has yet been attacked! Is it because the real quacks rank high in point of "wealth," and would combine against the hall, or how?

If the hall is sincere, why not break a lance with a university man (a man of mere theory), rather than crush a practical one, but without a degree? If public benefit be the real motive, surely the former is a fitter object for punishment than the latter.*

* The truth must come out. The hall will always be beaten if it ventures to refer to its condition in 1815. At that period it is well known it was in a most despicable plight. The dregs of society were its members; and it is only during the last ten or fifteen years that the sons of the ancient apothecaries, in order to keep pace with the times, have taken a series of determined steps to deceive and blind the public to the real nature of the origin of the company. But law is a ticklish thing. Upon certain issues that may be raised, the very root of the trading hall *can* and *will* be inquired into, and upon this field both physicians and surgeons beat the apothecaries, in origin, precedence, status, in fact in everything; and, as to antiquity, the apothecaries are positively whole ages behind both physicians and surgeons; and many are the anecdotes afloat, particularly among old military and naval surgeons, of the true character and light in which apothecaries were held even up to so recent a date as 1830. The action against Wells evinces their fear of even the chemists.

* I had gone thus far in my present letter when information reached me that the Advocate-General for Scotland, on behalf of his countrymen, had introduced a bill into Parliament, and that a committee of three or four M.D.'s

The following letter, addressed by Dr. Lobo to the secretary of the Medical Protection Society, has just been placed in my hands by Dr. Lobo in person. This document claims the serious attention of the profession:—

"A COPY OF THE LETTER ADDRESSED BY R. L. LOBO TO PRIDEAUX SELBY, ESQ., SECRETARY TO THE MEDICAL PROTECTION SOCIETY.

"Sir,—You will have the goodness to apprize the meeting of the medical profession that I was surprised again to see my name in the advertising columns of the *Times* of the 23d inst.

"The advertisement commences as follows:—'In consequence of the recent decision given in the County Court of Middlesex in the case of the Apotheearies' Society v. Lobo, we, the undersigned, think it advisable that you should call a public meeting of the medical profession, &c.'

"Now, sir, every one knows that there has been no absolute but a conditional decision. First of all I have denied the charge, 'although advised by the solicitor to your society to admit it'! However, considering it imprudent to contend in a court of law with two combined associations, I have declined the contest, and in order to save further trouble and expense I have promised to abstain from practising as an apothecary, provided it did not interfere with my acting as a surgeon and accoucheur; and in consequence of this arrangement the Apotheearies' Society have obtained the judgment, which is not to be enforced unless I break my promise and again practise as an apothecary.

"Such being the decision, with the testimonials and qualifications in my possession, I intend to practise, while I reside in this country, as a surgeon and accoucheur, as I have done during the last six years, and be at the same time prepared to meet my opponents should they again venture on assailing me.

"I expect shortly to establish the legality of my qualifications, by exhibiting several instances of English physicians and surgeons having practised in England with foreign and 'Scotch' diplomas without opposition.

"The expense necessary to become a member of the College of Physicians or Surgeons and the medical reform agitation have, hitherto, prevented my joining those learned and highly respected corporations, as it is impossible, at present, to calculate how the medical question will be ultimately settled.

"After a mature consideration I have preferred a legal diploma of a doctor of medicine and surgery, recognised and appreciated all over the world, to a certificate of the Apothecaries' Company, only useful in England and Wales.

"No wisely-directed association would compromise the dignity of its institution by persecuting, in a borrowed name, a graduate in medicine, equal to themselves in every respect, and suffer the ignorant pretenders, without any qualification whatever, to exercise their baneful influence over a vast mass of population.

"What explanation is your society prepared to offer to the public and the profession for oppressing a qualified practitioner, and at the same time permitting surgeons and graduates, the members of your association, illegally to practise as apothecaries, to the detriment of the legally qualified apothecary?

"Relying on the good sense of the English people, who have already expressed their displeasure and indignation, in conclusion I beg to state, that I am preparing for publication a detailed account of the circumstances, documents, &c., connected with the above arbitrary transaction, which I hope will serve not only as a positive refutation with regard to Counsel Griffits's erroneous opinions and statements, already circulated in the daily and weekly newspapers, but also will be an absolute denial of the intolerable pretensions of a few London medical monopolists.

"I have the honour to be, sir,

"Your obedient servant,

"RAPHAEL LOUIS LOBO.

"16, University-street, Euston-square,
March 25, 1849."

The trading company may rest assured Dr. Lobo is no common antagonist, and is now fully aware of his rights, and how he has been sacrificed. Rely upon it he will never leave the "unholy alliance" at peace that tried to destroy him, and is preparing efficient means to crush what he calls a miserable conspiracy arrayed against the best interests of the profession.

The association, it appears, suppressed Dr. Lobo's letter. It is as well they did. This simply tends to increase its importance in the columns of the *Chemical Times*, and, through you, sir, to the profession generally.

Preliminary Instructions for Defence, and at once available, either on plaint in the County Court, or on writ of summons in the Court above, as steps for future success.

Immediately any sufferer is served with process, let him retain two good counsel—a junior and a senior, the best and soundest men at the bar. Let him place before "the junior" the last and present numbers of the *Chemical Times*, containing the mass of legal principles I have set forth in my four letters, bearing directly upon these alleged causes of action, with instructions "to draw as many pleas as the body of law I have thus placed at his disposal will enable him easily to accomplish," particularly on the points of jurisdiction; defect of proper parties; no right of action (the company being a mere private body of tradesmen); the statute insufficient to carry the penalty; the Crown or public officer being no party; the penalty not enforceable for mere private gain (for which sole object the actions are brought). Let the counsel be instructed also to take those fatal objections which may be taken on points and grounds of public policy and right, and also to raise several issues to bring out the trading and shareholding character of the hall, and its real and sole object, and to show that examination fees, the penalties and the profits on drugs, are thrown into one general fund, for the sole benefit of a body of trading shareholders, after deduction of the current expenses. Let the counsel be instructed also to point out, on the grounds assigned, that the coexistence of a trade and profession (with high powers of examination, &c.) in the "same" body must appear to every thinking man a gross incongruity, particularly if the tenets and actions of that body tend to the prejudice of other much better educated bodies of men, emanating from universities and other public foundations, the growth of ages and of high professional excellence, and that, both in fact and in law, the professional right assumed by the tradesmen is opposed to the status and precedence of physicians and surgeons generally, and on the several grounds I have assigned, and that neither a paramount nor even a concurrent right exists in law to entitle the trading company to control or make amenable to its rules and regulations the upper orders of the profession, both physicians and surgeons disclaiming on their side any power or desire to control the L.A.C.'s, either by examination or by demanding a share in the profits of the trading company.

The junior having thrown into legal shape at least one hundred pleas (as he may well do) from a view of the whole facts disclosed, let a fair copy be made of them, and let this be filed in answer to the plaint in the County Court, or in answer to the declaration in the superior court, as the case may be. Let the junior so drawing the pleas attend and uphold them, and I will answer for it no county court judge will for one moment entertain the action. If he does, so multifarious will be the objections on the law and the facts that the superior courts must at once interfere. It is at this juncture that the senior will come in, primed by the junior in consultation, and both counsel will then work in harness, either on a rule nisi, or on other modes of raising the question before the courts above, and they will ultimately (if necessary) carry it before a court of error; and probably, finally, even before the House of Lords. In fact, all that is wanted is a good subscription fund (with full publicity), and then good by to Apothecaries'-hall and its adjuncts!

Very faithfully yours,

HENRY HUGH PYKE,

Barrister-at-Law of Twelve Years' Standing,
Originator of the Legal Education Movement, also of Medical Progress.

87, Chancery-lane, and Verulam Chambers,
Lincoln's-inn, May 17, 1849.

[To the Editor of the Chemical Times.]

Sir,—I was much pleased with your remarks on the "Iniquitous Proceedings of the Hall," in the cases against Lobo and Wells, and the intended victims of the "Medical Protection (persecution?) Society;" but I consider it would be more satisfactory to the majority of your subscribers if you were to enlighten them a little on the intimate connection between the master and wardens of the Apothecaries' Company and that precious society.

Their protecting-office is situated somewhere about the neighbourhood of No. 43, Lincoln's-inn-fields, and under the elbow of the Royal College of Surgeons, who ought to feel defiled by such close approximation; and where, for the more secret conducting of their iniquitous proceedings, they have a back way, leading to No. 6, Portugal-street. This *soi-disant* Protection Society publish a monthly circular on the 1st day of the month, but "this circular is only supplied to subscribers, and cannot be purchased on account of the private matter contained therein."

"Every subscriber has a secret number assigned to him by the office, and any information which the office may be desirous of affording him will be addressed to his number and not to his name." In like manner any subscriber, by his number only, may be an informer (and a secret spy), and denounce his neighbour to that persecuting society.

That society receives donations from its gentlemanly, enlightened, and liberal subscribers towards a fund for the prosecution (query, persecution!) of what they term "illegal practitioners."

In the "Medical Protection Circular," issued May 1, 1849, there is a short list of the latest donors to that fund, namely,—

"Charles Ridley, *Esq.* (help the mark!)	£1	1	0
William Collins, *Esq.*	1	1	0
J. D. Lane, *Esq.*	0	10	6
Messrs. Ince and Meates	1	1	0
John Brown, *Esq.*	1	1	0
W. H. Gardner, *Esq.*	0	10	6"

And then follows an appeal to members on behalf of the fund. Those and the like donations are forwarded to Peter Hood, another Esq., treasurer, Lower Seymour-street.

Therein you perceive the workings of that "Medical Protection" (persecution) "Society," under the cloak of the Apothecaries'-hall. Well might you term their proceedings "iniquitous." They are, indeed, disgraceful to the master, wardens, society, and all concerned. What! shall we, in this nineteenth century, permit such a vile society to exist and prosper upon the ruin of thousands? I know not whether that society and the hall are indictable or not for a conspiracy, but I think every upright man in this kingdom

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(a trifling section out of nearly four hundred strong), belonging to only one German university—of which the diploma constitutes their only title to practise in England—have taken the requisite steps to put their university in motion (through their ambassador and other influences), and also to obtain a complete list of the members of that university now practising in England, Wales, Scotland, and Ireland. This, let it be borne in mind, is only one foreign university. The members of others will undoubtedly follow the example, and will combine to raise funds for mutual protection of rights. So much for the effects of persecution! The chemists are fairly up, and have given the first good body blow to the trading company. The Irish and Scotch are also at work.

will be ready to condemn their iniquitous proceedings.

I would suggest an efficient plan to scotch the vile thing, that persecuting society, and that is: That the leading or other members of pharmaceutical, chemical, and other societies call a public meeting without delay, whereat resolutions should be passed denouncing every member of the *soi-disant* "Medical Protection Society," and their iniquitous proceedings; that a resolution be passed, and signed by every chemist and holder of either Scotch, Irish, or foreign diplomas, to the effect that they, the chemists and druggists and their families, and the others named, will resolve from henceforth to refuse to consult, employ, or hold any professional communication or intercourse with any member of the Apothecaries' Company, and that in future they will consult only physicians and pure surgeons; that a resolution be passed to the effect that a subscription be at once entered into, to form a fund, for the purpose of defraying the usual expenses of the meeting, advertising, and defending any and every member of the profession enrolled as a subscriber to this fund from any prosecution, indictment, or action at law, whether instituted by the master and wardens of the Apothecaries' Company, the "Medical Protection Society," or any other existing or future prosecuting or persecuting society, company, hall, or college.

A consultation with Mr. H. H. Pyke, the barrister, and the leading or other chemists, might result in immediate action; and as there is no telling what kind of a bill for regulating the medical profession in future may pass the House of Commons, and become law, it is advisable that all chemists and druggists, and all other parties interested, rise as one man to defend their rights.

Let them bear in mind the memorable remarks of Sir Benjamin Brodie, in his evidence before the select committee on medical registration, in the House of Commons, June 25, 1847. He said, "I think it would be very unjust to prevent me consulting any body I please about my own case; and that whoever I think proper to consult should have a right to attend me, and that the Government should not interfere."

All but the apothecaries and general practitioners entertain the same opinion, and, in spite of intriguers and silly legislators, will maintain their indefeasible right.

Now, then, is the time to show their determination.

Let the great body of chemists and druggists assemble in public meeting, consult, discuss, and resolve to act, and their future safety and prosperity will be secured.

Let their proceedings be published in all the leading journals, and especially in all those other journals and periodicals which have a circulation amongst tradesmen and the working classes.

Your obedient servant,

M. D.

[To the Editor of the Chemical Times.]

Sir,—Since writing to you yesterday I received the published proceedings (published in the "Medical Protection Circular") "at a meeting of the Medical Protection-office, called by requisition, held on Monday evening, the 26th of March, 1849, at the Freemasons' Tavern, Great Queen-street, which was most respectably (query?) and numerously attended, many of the leading members of the profession being present." Such is the wording of the leader, or introduction to the proceedings, over which presided a "Mr. Propert," who "was unanimously called to the chair." In order that your subscribers and the public generally may be made acquainted with the iniquitous proceedings of this secret society, who have declared a war of persecution against the chemists and druggists, I think it would be advisable if you would publish the proceedings alluded to, and that you recommend your brother journalists and contemporaries to do the same. Ten monthly numbers of the "Medical Protection Circular" have been published and issued. The printers are Brewster and West, Hand-court, Dowgate. If you have not received those circulars, or any of them, it is possible you might do so through some friendly channel. If you cannot get them, I will send you a correct and verbatim copy of the proceedings of the 26th of March, confidentially, for publication, by which you will perceive that the prosecutors and persecutors of Dr. Lobo and Mr. Wells are not the master and wardens of the Apothecaries' Company; that it is not Mr. Upton, their solicitor, who was employed to prosecute, but a Mr. Eyre, who is the solicitor to the Medical Protection Society. You will also see that this precious society "anticipate that the office will in some cases obtain half the penalty;" and they "calculate that the requisite staff" of informers, &c., "for procuring evidence may be supported by this means." A "most respectable" and honourable set, truly!

A Mr. Jones, of Portugal-street, is reported in that report of the proceedings to have confessed that *he* had been the means of bringing the case of Dr. Lobo under the notice of the society and their solicitor, and, through them, before the public. He is reported as having said:—"In consequence of some communication I had from Mr. Eyre, the solicitor of this association, that he could, if furnished with the necessary materials and evidence, bring these sort of practitioners at once to justice by the summary proceedings of the County Court, I determined on rendering him all the assistance in my power. I candidly confess that I was, and had been for a long time, on the look out for this sort of persons, and having, in my capacity of district registrar, received a certificate of cause of death, as required by the Registration Act, signed by this Mr. Lobo, and having received some intimation that he was just one of the parties I was on the look out for, I wrote a letter to this Mr. Lobo, and he wrote to me a letter in reply, in which he stated that he held a diploma as doctor of medicine and surgery of the University of Giessen; asserted that he had been connected with some public institution here, and also stated that he was a very clever man, and offered to produce testimonials from various persons to that effect. I am sure he would not have made these statements, especially the last, if he had known that he had a professional man to deal with," &c. Such a confession, though made in secret conclave, has been published, together with the names of the principal speakers and actors at the aforesaid meeting. The chemists and druggists, and all others interested, will therefore, perhaps, remember the Joneses.

According to the printed report above alluded to, Mr. Propert opened the proceedings by a speech adapted to the occasion and to the company assembled. He was followed by a Mr. F. W. Breary, the manager, who read his "address." After which the chairman read a letter from Dr. Lobo to Prideaux Selby, Esq., the secretary of or to the Medical Protection Society. Then followed Mr. Jones. After him Mr. Eyre, the solicitor to the society, rose up, and said:—"I think, gentlemen, after the polite attention and kindness I received from Mr. Jones in this matter, I am bound to offer a few words in explanation of what has taken place. Our worthy chairman, Mr. Propert, has read to you the letter of Mr. Lobo, in which he makes some complaint of the manner in which, as he says, he has been treated. I was in his case anxious, as I am in all others, that everything I did should be fair and above board [Oh!]; and as there appears to be a sort of impression about, from the form in which the case was reported in some of the papers, and some comments that have been made by them on these reports, that I had written to Mr. Lobo, and, getting him to my office, had threatened and frightened him into doing anything I wished him to do, I beg to assure you, gentlemen, that this is not the fact; that I was not only in communication with Mr. Lobo, but with his solicitor also, by whom he was attended at my office; and it having been represented to me by both Mr. Lobo and his solicitor that he was a very poor man, and that a prosecution would be his ruin if he were forced to pay the penalties, and as my object was chiefly to show persons and the profession in general that we were determined to protect the interests of the profession, and that we had discovered a cheap and efficacious mode of so doing, I had no wish to crush, to oppress, or to ruin any man [Marvellously merciful man!], and I therefore made a suggestion that he should write a letter to Mr. Upton, the solicitor to the Apothecaries' Society, acknowledging that he had acted illegally, and without the sanction of that body, as an apothecary, and, if he promised to abstain from offending in the same manner, I would recommend that the society should forego the penalty in this case, it being the first we had taken up; but I distinctly refused to make it a matter of any private compromise, and insisted that it should be brought into court and made as public as possible. [Kind, considerate man!] I am, however, instructed not in future to forego the penalties in any case, and you may depend upon the law being, so far as *we* are concerned, enforced with all possible vigour and determination."

After the solicitor followed a Mr. Clifton, who said as follows:—

"Mr. Chairman, I think every gentleman must feel now the great misfortune it has long been to the medical profession that they have received, and do receive, so very little protection from the powerful body (Apothecaries'-hall) instituted for that very purpose. This, perhaps, may have arisen partly from the want of funds, and the great expenses incurred in prosecutions on former occasions; but it has gone to such an extent, and so greatly to the injury of the profession, that we cannot help imputing it to neglect, and a culpable apathy to the interests of that profession for whose benefit those somewhat extensive powers were conferred, and to the great prejudice of the respectable and clever practitioner. The noble stand that has been made by this institution and their solicitor must entitle it to the sympathy of the profession at large, and I do not think I am saying too much when I call upon all who hear me to lend their best assistance to the office in its earnest endeavour to carry out its praiseworthy objects; and I consider it deserving the support of every man who is anxious to maintain his own respectability [query?], and who has at heart, as he ought to have, the interest and respectability of the profession at large. The impression made on the public by the proceedings of these quacks, and other unqualified practitioners, is very derogatory to the credit and character of the profession. I say I hail with delight, and I think I may speak for all here, and say, we hail with delight, this opportunity of testifying to the institution the gratitude of the profession for the noble stand they have made in our behalf. Gentlemen, we do not wish to injure others [Oh, no!], but to maintain our own respectability [How funny!], and who shall say that is not a praiseworthy object? and it is also evident that this is one of the objects of the society. In following out the design of their institution, the society must know but two classes of practitioners—regular and irregular—and can ask but one question, whether legally qualified or not legally qualified. We may be inclined to regret that it should be so when we find men who certainly possess some medical acquirements, and we should not like individually to proceed against men who lived in our own neighbourhood; but these feelings and sympathies cannot be known to any institution as a public body. The law is still the law; if it be a bad law, let it, after proper and due consideration, be represented to a higher power, and altered or abrogated; but while it is the law it is the bounden duty of every man to obey the law himself, and, for the sake of the character of his profession, to take care it is obeyed by others. I shall conclude by proposing for your adoption the first resolution."

Then followed a Dr. Lobb, who read the second

resolution, viz.:—"The importance to the medical profession, by promptly putting down illegal practice by similar prosecutions, must commend itself to the approval of every qualified medical practitioner, and that it is, therefore, expedient that a general fund be established to assist the Medical Protection-office in carrying out this desirable object."

"Resolution seconded by Wallace, who said, 'It must be very evident to us all that the objects of this society are such as to command our sincere support, and, that they should be fully carried out, this cannot be done without the sinews of war.' Carried unanimously."

After that a Mr. Mathews spoke, and then followed a Mr. Lord, who moved the next resolution: — "That subscription-books be immediately opened to receive the contributions from the members of the office to assist its efforts to carry out these prosecutions with increased energy."

A Mr. White seconded that resolution.

Then followed Mr. King, Mr. Jones, Mr. Bowling, Mr. Dale, the chairman, Mr. Clifton, Mr. Wallace, and Mr. Sexton, who thought the chemists and druggists "much the fittest persons to attack."

"The chairman then introduced Mr. J. O. Griffiths, the counsel who conducted the case against Lobo, and a number of questions were asked the learned gentleman relative to the law as affecting surgeons, chemists and druggists, &c., from which it resulted that his clear opinion, which he fortified by authorities, was, that chemists and druggists were liable to the penalties if they dispensed the prescription of a physician, or in any way departed from the legitimate duties of a chemist and druggist, or interfered with the practice of an apothecary."

So much of the No. 9 of the "Medical Protection Circular," issued 2d of April, 1849, printed by Brewster and West, Hand-court, Dowgate. It tells its own tale, and is a sufficient inducement for calling a public meeting of all the chemists and druggists for the purpose of devising plans and raising means in order to carry them out, for the purpose of defeating the iniquitous proceedings of the *soi-disant* Medical Protection Society.

I hope, Mr. Editor, you will use your best endeavours to give great publicity to the above extracts, and to assist the chemists and druggists in defending them against their persecutors.

I am, sir, your obedient servant,

M. D.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

George Arthur Biddell, of Ipswich, engineer, for improvements applicable to gas-burners. Patent dated November 2d, 1848. Enrolled May 2d, 1849.

This specification relates to the adaptation of a peculiar apparatus to ordinary gas-burners, for the purpose of regulating the supply of gas thereto; and this independent of the pressure of the gas. The mode of effecting this, as adopted by the patentee, is to employ two rods or tubes of different powers of expansion. Upon exposure of these rods or tubes to the action of a flame, their unequal expansion causes them to act upon a valve or cock, in a manner to admit more or less gas to the burner, according to the height of the flame, and consequently to the intensity of its heat.

The engraving which accompanies the specification shows an ordinary gas-burner to which the apparatus of the patentee is applied. It is adapted for a single light, but, should more than one light be required to be supplied by the same apparatus, then the construction of it is to be modified, by enlarging the valve, delivering the gas in proportion to the number of burners to be supplied, and carrying a pipe from above the valve, for the purpose of supplying these burners. Thus it will be seen that although the patentee's apparatus may be only attached to one of the burners, yet by this arrangement the whole of the burners are subject to its influence. The burner represented in the engraving which accompanies the specification is of the ordinary construction; it is mounted upon a pipe or stem, the lower end of which terminates in a valve-box, to which the ordinary gas supply-pipe is likewise attached, below the valve. The spindle of the valve passes upward through the upper part of the valve-box, which it fits very accurately—sufficiently, indeed, to prevent any leakage of gas, without the use of an ordinary stuffing-box. The valve and valve-box are so constructed that when the valve is raised a short distance only a free flow of gas passes through it to the burner; but if raised a little higher it very nearly fits the upper part of the box, which is of a reduced diameter, so that but a very small quantity of gas will now pass. A small groove or flat is cut upon one side of the valve, for the purpose of passing a small quantity of gas, that the flame of the burner may not be quite extinguished when the valve shall be raised to the upper end of the rod of the valve. Outside the valve-box is attached the end of a lever, the fulcrum of which is a pin, passing through a piece projecting from the pipe or stem. The outer and shorter end of the lever passes on both sides of this projecting piece. Through the latter is passed a long steel wire or rod, screwed at the lower end, to which is affixed a button or knob, for the purpose of turning the rod when required. Around the steel rod is placed a small brass tube, the two (the rod and the tube) being connected together at their upper ends; or a shoulder or head may be made to the rod, to prevent the brass from rising, when expanded by the heat. The lower end of the brass tube rests upon a smaller ring, which is borne by the short ends of the lever. Thus it will be seen that the heat from the flame, when the gas is let into the burner, has the effect of expanding the two metals—namely, the steel rod and brass tube—unequally; the greater expansion of the brass causing the short end of the lever to be depressed, while the opposite end and the valve attached to it are raised, thereby allowing the gas to be passed to the burner, and any increase or decrease of the flame (by consequent increase or decrease of the lengths of the two metals) opens or closes the valve as required, to regulate the supply of gas. The mode of lighting or managing the burner is as follows:—The valve being closed, the knob is turned in one direction (dependent upon whether a right or left handed screw is used). This has the effect of raising the valve a short distance; thereby allowing gas to pass to the burner, which may now be ignited. The heat from the flame causes the expansion of the two metals, thereby raising the valve still more, and allows more gas to pass to the burner, and the flame to be increased. After a short time the two metals will have attained the highest temperature the flame can communicate; the flame may now be easily adjusted, by turning the knob in either direction, as required. Should any further variation of the height of the flame take place, the effect of the heat produced upon the two metals will self-adjust the position of the valve, and consequent supply of gas. Should the flame rise too high, and thus produce great heat, the effect will be nearly to stop the supply of gas to the burner, by lifting the valve into the upper or contracted part of the valve-box.

The patentee claims the application of two substances of different degrees of expansibility, for the purpose of regulating the flame of gas-burners.

Also the construction of regulators, for the purpose of striking off the supply of gas to the burner.

Also the construction of a valve, as described, for totally shutting off the supply of gas in one direction, and only partially in the opposite direction.

Also the method of constructing gas-tight those parts through which any rod or spindle passes, and dispensing with the use of stuffing-boxes.

William Longmaid, of Beaumont-square, in the county of Middlesex, gentleman, for improvements in treating the oxides of iron, and obtaining products therefrom. Patent dated October 26th, 1848. Enrolled April 26th, 1849.

This specification describes a new mode of operating upon the oxides of iron, for the purpose of obtaining therefrom pigments and other products.

The mode of operation is as follows:—

The oxide of iron is to be reduced to a finely pulverized state, and then to be intimately mixed with some resin or tar, or other carbonaceous material, the patentee preferring the use of resin or tar for the purpose; the proportions he recommends are from about 10 to 15 per cent. of the carbonaceous material, according to the greater or less amount of carbon contained in it.

The patentee prefers to use a quantity of the carbonaceous material a little in excess of that necessary for the operation. The carbonaceous material, if dry, is to be reduced to powder; if fluid or semi-fluid, it is mixed with the oxide in that state, and the mixture afterwards dried and reduced to powder. The pulverulent mixture is then placed in retorts or other proper close vessels, either of cast iron or other material; these vessels are about five feet long. The quantity of each charge is about 1½ cwt. The open end of the retort is now closed with a cover, and then placed in a suitable furnace, in a vertical position; the open end (with the cover secured upon it) being placed downwards, that the gaseous matters evolved during the process may pass into the furnace and be consumed; the retort is then gradually heated to dull redness, and suffered to remain at this temperature for about two hours after the evolution of the gaseous products has ceased. The retort is now removed from the furnace, and allowed to cool before the contents are withdrawn—as by allowing the latter to come into contact with the atmosphere while in a heated state the quality of the products would be injured. The product thus obtained is a dark-coloured matter, which may be used as a pigment; ground with oil, it will form a paint. Instead of allowing the gaseous products evolved to pass into the furnace, they may be collected by closely luting the cover of the retort, and applying a pipe to carry them off to a condenser and gasometer: the gaseous products which may be thus collected and utilized are a volatile oil, and an inflammable gas fit for purposes of illumination.

The patentee claims the mode of treating oxides of iron by mixing them with carbonaceous matters, and subjecting them to heat, for the purpose of obtaining products therefrom as described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MAY 10TH, 1849.

William Newton, of Chancery-lane, civil engineer, for improvements in the jacquard machine. Patent dated May 5th, 1849; six months (Communication.)

George Edmond Donisthorpe and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and hackling fibrous matters. Patent dated May 8th, 1849; six months.

Robert Sutcliffe, of Idle, near Bradford, in the county of York, cotton-spinner, for improvements in machinery for spinning cotton, silk, and other fibrous substances. Patent dated May 8th, 1849; six months.

George Henry Dodge, citizen of the United States of America, now residing at Manchester, manufacturer, for certain improvements in machinery for spinning and doubling cotton yarns, and other fibrous materials; and in machinery or apparatus for winding, reeling, balling, or spool-

ing sueh substanees when spun. Patent dated May 10th, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. Reynolds, of Neath, ironmaster, for eertain improvements in railways. Patent dated May 5th, 1835; expired May 5th, 1849.

W. Simpson, of Evesham, for a safety-drag, or lever-slide, for earriages. Patent dated May 9th, 1835; expired May 9th, 1849.

J. Egg, Piccadilly, gunmaker, for improvements in certain deseriptions of firearms. Patent dated May 9th, 1835; expired May 9th, 1849.

A. H. I. F. Valois, of Lyons, France, for a certain improvement or improvements in the mode or method of produeing engravings, etchings, or reliefs, on metallie plates (for produeing impressions therefrom), and in the apparatus used in the same. Patent dated May 13th, 1835; expired May 13th, 1849.

On the Components and Preparation of Noiseless Congreves or Lucifers.—Aeeording to the observation of Dr. R. Boetger, all eongreves whieh ignite with a crackling report eontain ehlorate of potassa. The eolouring matters are smalts, peroxide of lead, or peroxide of manganese. Of the materials for smouldering (toueh) paper, some are imbued with saltpetre, others with bichromate of potassa, and, again, some with acetate of lead. Those containing saltpetre are to be preferred, sinee they furnish a more permanent glowing red light when ignited. The best proportion for the mixture of the igniting mass, and which burns with the least noise, is the following:—16 parts of gum arabie, 9 parts of phosphorus, 14 parts of saltpetre, and 16 parts of vermilion. Instead of gum arabie, mucilage of gum tragaeanth might be employed. In order to prevent the injurious influenee of the oxygen of the atmosphere on the mass, it is advisable to eover the points of the matehes, after being dipped and dried, with a dilute varnish of copal, or with a solution of gum eontaining saltpetre.

New Mineral from Brazil.—M. Dufrenoy exhibited before the Academy of Seienees at Paris a speeimen of a mineral from Brazil, whieh appears to be to the diamond what emery is to eorundum, as stated by M. Elie de Beaumont. Among some specimens reeently sent to the Ecole des Mines by M. Hoffman, a dealer in minerals, were two whieh were stated to be hard enough to polish the diamond; and, in fact, the hardness of these speeimens was found to be superior to that of the topaz. This substanee was analyzed by M. Rivot, mining engineer, who had at his disposal one large fragment weighing 65.760 grs., and several small pieees weighing rather less than 0.50 gr.; the latter only were analyzed. The large fragment appeared to eome from the same alluvial formation as that in which the Brazilian diamonds oeeur. Its edges are rounded by long friction; but it has not the appearanee of a rolled flint. It is of a slightly brownish dull black eolour. Viewed with a glass, it appears riddled with small cavities separating very small irregular laminæ, whieh are slightly translucent and irideseent. The brown colour is very unequally distributed throughout the mass. On one of the faees the cavities are linear, whieh gives it a fibrous aspect similar to obsidian. It euts glass readily, and seratehes quartz and topaz; its density is only 3.012. The small fragments subjeeted to analysis weighed 0.444 gr., 0.410 gr., and 0.332 gr.; their densities were respeetively 3.141, 3.416, and 3.255. These numbers indicate great differenee in the porosity of the speeimens; they lead, however, to the eonelusion that the density of the substanee is very nearly the same as that of the diamond. By means of long ealcination at a bright red heat in a eovered erucible, the speeimens were not altered; they retained their aspect, hardness and weight; they do not, therefore, contain any substance volatilizable by calcination out of contact of the air. This result certainly does not prove the igneous origin of these diamonds, but renders improbable the idea expressed by M. Liebig, that diamonds are derived from the transformation of organie vegetable matter. The three speeimens were suceessively burnt in pure oxygen gas in the apparatus employed by M. Dumas for the combustion of the diamond. The oxygen obtained from ehlorate of potash was eontained in the gasometer; it was dried and purified before it reached the combustion-tube by passing through two tubes eontaining sulphuric aeid and pumice, and one tube with potash; employing this method with the precautions indicated by M. Dumas, 100 of the

	Carbon.	Ash.	Loss.
1st speeimen gave	96.84	2.03	1.13
2d " "	99.73	0.24	0.03
3d " "	99.37	0.27	0.36

In the combustion of the first speeimen only one bulb-tube with potash was employed, so that a portion of the earbonie aeid produced by the combustion was lost; but in the other two experiments, in whieh two bulb-tubes containing potash were used, the seeond inereased in weight some eentigrammes. The two last analyses prove perfeetly that the speeimens are composed entirely of earbon and ash. The ash was yellowish, and in the first speeimen it had retained the form of the diamond. When examined by the microseope, the ash appeared to be eomposed of ferruginous alumina and small transparent erystals, the form of whieh could not be ascertained.—*L'Institut*, Mars 2, 1849.

Black Rain in Ireland.—We make the following extraet from a report of the proeeedings of the Royal Dublin Society in a late number of the Dublin *Freeman's Journal*:—"Professor Barker presented to the notiee of the society a bottle containing a portion of black rain which had been transmitted to him from Carlow, with a view to satisfy the seruples of many persons who appeared to doubt that rain of this deseription had fallen. He had reeeived eommunications on the subject from persons residing in several of the distriets in whieh the rain had deseended, and he was in a position to state, not only that such rain had actually fallen, but to mention the spaee of eountry over whieh it had been diffused. The specimen whieh he presented to the soeiety had been sent to him from Carlow, aeeompanied by a letter, in which the writer mentioned that at the time of its eollection it was uniformly blaek, and resembled ordinary writing ink; but he (Doctor Barker) found that, after allowing it to stand for a short period, the black eolouring matter separated from the water with whieh it had been mixed, renderin, the colour of the rain much lighter than at first. The places in which this phenomenon oeeurred were Abbeyleix, Carlow, Kilkenny, and Athy, from which it would appear that the black shower had extended over an area of more than 400 square miles. As far as he had been able to aseertain, it oeeurred about six o'clock in the evening of the 14th inst., being preeeded by sueh extreme darkness that it was impossible to read exeept by candlelight. After this darkness had existed for some time, a hailstorm, attended with vivid lightning, but without thunder, oeeurred, and when this subsided the black rain fell. It was mentioned by his Carlow eorrespondent that upon examining a quantity of this rain just after it had fallen he found it had an extremely fœtid smell, and a very disagreeable taste; that it had left a stain upon some elothes on which it had fallen, and that eattle refused to drink it. At Abbeyleix and Athy, where the shower deseended at the same moment, the appearance of the rain was preeisely similar to that whieh fell in Carlow, but it was unaccompanied by the lightning which had been observed at the latter place. Dr. Barker then stated that as yet he had not been enabled to make a complete ehemieal analysis of the rain."

Testing of Paddle-box Lights.—An experiment took place at Woolwieh Dockyard on Tuesday night (May 15), in the presenee of Commodore Henry Eden, and several other officers, to ascertain the comparative merits of the red and white lights of the lamps fitted to the Blaek Eagle steam-vessel, with the red and white lights of lamps eonstrueted on a plan suggested by a noble lord an offieer in the Life Guards. The new lamps were under the direction of Mr. Reece, ehemist, Piecadilly, and are supplied with a eamphine liquid whieh produces a strong and very brilliant light, far superior to those in general use, and they require no trimming or attention for lengthened periods. The flame of the new lamps appears similar to the steady and uniform flame emitted from gas-burners, and it retains its brilliancy while any of the liquid remains. The lamps are remarkably clean, scarcely any smoke being generated.

Births and Deaths during the Week ending May 12.—The return of the Registrar-General for the week ending Saturday last indicates an improvement in the public health. The deaths registered are 58 below the average, being 905 from all causes. The deaths from epidemic diseases 206, being above the average of the two preceding weeks. The mortality from bronchitis and pneumonia has fallen, and now only exeeeds the average to an inconsiderable extent. The fatal eases of eholera are three, viz.:—St. Martin's-in-the-Fields; Long-acre.—F. 55, "spasmodic cholera (1 day)." West London; South.—At 112, Chancery-lane, F. 70, "purpura (5 days); cholera (56 hours)." Shoreditch; Hoxton Old Town.—F. 69, "cholera Anglica (26 hours)." The total number of births during the same week was 1,479. The mean height of the barometer was 29.835 inches. The mean daily height was above 30 inches on Saturday only. The mean temperature of the week was 45° 5′.

TO CORRESPONDENTS.

"Leicester."—1. Grind the eocoa beans to a very fine powder, and mix this with sugar. In this state the cocoa powder is miscible with boiling water. 2. Take of fresh ox-gall, one pint; boil, skim, and add an ounce of pounded alum. Boil again until the alum is dissolved; let the mixture cool; when sufficiently cooled, pour it into a bottle and loosely cork it down. Boil and skim another pint of gall, and add to it one ounce of common salt. Boil till the salt is dissolved; let the liquid cool, and bottle it as above. After three months decant the *clear* fluid from both bottles, and mix the decanted fluids in equal proportions: a coagulum will form, which is to be removed either by subsidence and decantation, or by filtration. 4. We think Fresenius' "Qualitative and Quantitative Analysis" will answer your purpose.

"A Student."—We will let you know in our next week's number.

A correspondent writes to us as follows:—"Can you inform me about the brass letters which are placed upon the glass panes of shop-windows—whether they answer the purpose or not? About the price, and where they can be procured—also, if they can be readily cleaned?" Will any of our correspondents oblige us with the desired information?

"J. B. D."—The so called white lac is prepared as follows:—Boil shellac in a ley of pearlash or caustic potass until the lac is dissolved. Filter the solution; pass chlorine in excess through the filtrate, wash the precipitate, and digest. For the process of gilding we refer our correspondent to No. 132 (page 251).

"T."—Communication received.

"Mr. Wanfield, Bristol."—Eaton's styptic is simply an alcoholic solution of sulphate of iron, disguised by the addition of some other ingredients.

"R. R. R."—Chromate of lead.

"Mr. T. L. Rowe."—Two parts of the concentrated acid and three parts of water. Mix slowly and gradually.

"R. L."—Our correspondent must furnish us with his *real* name and address before we can insert his letter.

"Mr. Blundell."—In the course of a fortnight.

"A Druggist."—Apply to Mr. Jacob Bell.

"A Subscriber."—The matter is not yet decided.

ORIGINAL SERIES.

ON BENZOLE: ITS NATURE AND UTILITY.

A LECTURE.

By C. B. MANSFIELD, Esq.

[*Continued from page* 377.]

That, in the present age, when the creative faculty of man seems to be more than ever busy in its obedience to the primitive injunction to subdue the earth, the production of light should have been one of the earliest aims of British industry, seems but to be consistent with the harmony and order of the world. For the daily experience of life,—of social as well as of organic life,—pronounces light to be the chief necessary of man, no less than of every other living thing; and sense and science alike at once accept as truth, that light was the first material force that worked in the embryo universe.

From the tallow dips of the last generation, formless, and void of everything but smell, to the bright stearic acid that cheers our drawing-rooms now, what a development! In the iron arteries of our towns, in the constellations of burners that rule the nights of our favoured days, rising over the chaotic blubber-lamps of our fathers, what a creation! And can we doubt that the same voice that first bade light to be, summoned gas to our service, and has pronounced the light of gas to be good?

But, though gas-light is good, gas might, perhaps, be better; and, though stearine is good, are we to rest from our work content with our present appliances? The answer comes up from the depths of Chancery-lane, repeating the patents for "improvements in the production of light" which every new moon sees added to the list; from every new lampsmith's shop in this metropolis, each with its own new and peculiar lamp, with a newer and more peculiar name; and from the crowds that were lately gaping their admiration at the electric paragon of lights. And the negative is echoed back from the vast domes of the gasholders whispering that their contents are not perfect in purity; and from the Irish peat-bogs hinting that paraffine, the fat of the earth, may prove cheaper than the grease of beasts.

Where, then, so much practised ingenuity has been expended it may seem presumptuous in our benzole to start up, Aladdin-like, with a new and wonderful lamp; yet, to advance among a host requires less of impudence than does the trial of an untrodden path. And surely the darkness which is wide enough, in our winter nights, to give room for candles, lamps, gas, and electricity, may have still some corners left for other little sparks to twinkle in. There is neither monopoly nor competition in the firmanent in which the lights, the greater and the lesser, and the stars also, proclaim the sympathy of all things; and, perhaps, the jealousy of rival splendours here is less a measure of their prosperity than of their disorder.

The result, however, of our last experiment will probably have suggested to your minds the possibility of using common air, charged with the vapour of benzole, as a substitute for coal-gas, for artificial light. You will have inferred, too, correctly that the facility with which the liquid hydrocarbon is purified, and the integrity of its chemical character, would make it preferable to common gas wherever simplicity of process and purity of material may be requisite. Here is an apparatus which has been contrived for carrying this principle into practice as a system of lighting, and which has succeeded better in "burning the wind" than, hitherto, it has in "raising" it.

Here is a closed copper vessel containing a few ounces of benzole; it is furnished with two tubes, one of which enters it, and dips into the liquid; another passes simply from the top of the vessel, and leads by connecting pipes and branches to several burners; the other tube is attached to a gasholder, which is filled by a pair of bellows. By turning a tap in this latter pipe the air is at once admitted to traverse the whole apparatus. At each or all of the jets the air may now be lighted, and the supply may be turned on or off with as much facility as common gas. You will judge for yourselves whether coal-gas can hold a burner to it, for comparison in point of brilliancy. As for price, benzole may be made for 2s. 6d. or, when coal-naphtha is very dear, 3s. 6d., per gallon, which is equal to about a thousand cubic feet of gas.

I should point out to you that the evaporation of the benzole produces cold, just as ether poured upon the hand chills it, by converting some of the animal heat into expansive force, as it volatilizes. So the volatile hydrocarbon cools itself, or, rather, what remains of it is cooled, by the evaporation of that which is first given off, and so its tendency to be consumed is diminished; the one part is saved by the sacrifice of the other. This would continually diminish the quantity of vapour evolved, for at a lower temperature all liquids are less volatile than at a higher, and consequently the light would be continually deteriorating. Here is a test-tube containing a small quantity of benzole; two tubes, as before, pass through its cork; by one air enters, by the other it escapes. I allow the current to pass for a minute or two; at first it burns brightly white; you see, however, that, as the abstraction of the spirit proceeds, my little luminary assumes about its lower limb a blue tinge, which gradually encroaches on the pure white part till only a yellow tip remains, which finally will disappear, leaving only a blue cone, beautiful but lightless—the shape without the body of my former flame.

A temperature not below the average of our atmosphere, or about 63° Fahr. (17° Centig.), is necessary to enable the air to take up of the benzole sufficient to maintain a brilliant light. The evaporating-vessel may be easily kept from falling below this temperature by causing a small jet of flame supplied by the apparatus itself to play upon its side. This, however, might not be enough for perfect regulation; you will readily conceive that, without occasional adjustment of this little burner, the evaporating-vessel might become warmer than is requisite, and too much vapour might be evolved. If, for instance, the flame were adjusted so as to compensate exactly the evaporation due to any number of burners, the light would remain constant for any length of time; but if several of this number were to be shut off the supply of heat would soon exceed the absorption; the temperature of the vessel would rise, and the lights might begin to smoke. It was desirable, therefore, to apply a limit to the rise, as well as to the fall, of the temperature of the benzole reservoir. This was contrived by an instrument which may be called a "thermostat," which is attached to this copper evaporating-vessel, and is represented in these diagrams.

Fig. II. is a front, and Fig. III. a side, view of the evaporator with the thermostat, each partially in section. *A* is the evaporating-vessel. *B* a

FIG. II

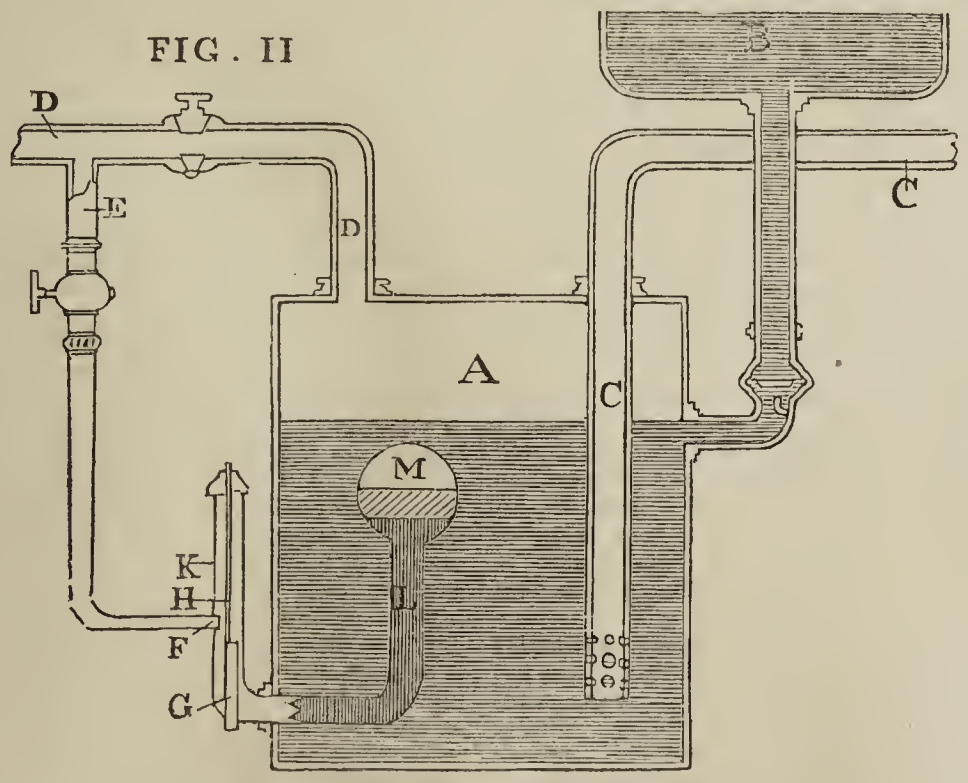
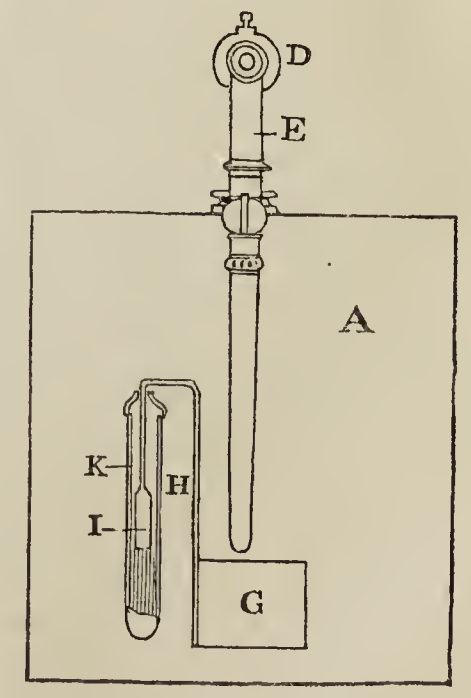


FIG. III



fountain, closed above, which supplies the liquid to *A* at a constant level. *C* the pipe by which air enters, *D* that by which it escapes charged with vapour. *E* a small branch pipe by which the flame at the jet *F*, directed towards the side of *A*, is maintained. *G* a small screen of talc, or of other light fireproof material. *H* a wire which carries *G*, and depends from the top of *I*, a small rod of light wood or cork, which rests on the surface of some mercury in the outer leg *K* of the U-shaped tube. *L* the other leg of this tube, within the vessel *A*, terminated and closed by the bulb *M*. In *M* is placed a small quantity of ether, or of other highly volatile liquid, resting on the surface of the mercury, which occupies the

lower part of the bulb and all the bent part of the tube from the ether to *I*.

When the temperature of *A*, and consequently of *M*, rises the ether begins to evaporate, and the expansion of the vapour* depresses the mercury in the leg *L*, and raises it in *K*. The mercury rising in *K* carries up with it the rod *I*, and with *I* rises the screen *G*. *G* is placed at first below the level of the little burner, so that when it rises to a certain height it just intercepts the flame, and stops the supply of heat to the evaporating-vessel. But no sooner is the temperature of *A* reduced ever so slightly by the evaporation than the mercury begins to retreat, and the screen to fall, again exposing *A* to the little flame. Thus the temperature becomes self-regulating; by altering either the height of the burner or of the screen the degree at which the temperature shall become constant may be fixed at will with the greatest nicety. Thus you will see that during the remainder of the evening the lights supplied from the reservoir on the table, which is fitted with a thermostat constructed in this manner, will remain undiminished in brilliancy, as, indeed, they would until all the liquid in the vessel was exhausted.

The quality of flame arising from the combustion of any fuel depends, as you are well aware, on the quantity of air supplied to it. When we say that alcohol burns with a blue, and benzole with a smoky, flame, we do not speak of any absolute property of these compounds, but of the phenomena of their combustion under the ordinary condition, of ignition in the open air. Alcohol will evolve smoke when burned with access of only enough oxygen to consume its hydrogen. Benzole, as you have already seen, will burn with an exuberance of smoke, with a perfectly white, or with a lightless blue, flame, according to the proportion of air supplied to it at the point of ignition. I have just been endeavouring to exhibit to you the utility of our hydrocarbon as a source of light. I wish now to show you that it is also available as a means of heat. For this purpose I must resort to it in the state of blue inflammation. As a general rule blue flames are hotter than white ones, and this comparison is certainly true of these two conditions of any one material. In the white luminous flames a portion of the available heat is converted into light by the ignition of the carbon—the pre-eminent source of terrestrial light—which is deposited in, and traverses, the flame. If there be an excess of this carbon above a certain proportion it robs the flame largely of heat; but, if below the mean quantity necessary for the production of white light, it repays by its own combustion a portion of the heat which it borrowed from the hydrogen for incandescence. If, however, we supply so much oxygen to the flame that the carbon is instantly consumed with the hydrogen, giving it no time for a display of brilliancy, we get at once, and with the greatest rapidity, all the heat which we are entitled to derive from our fuel. Now, we can contrive this with benzole by causing its vapour to mix rapidly with a sufficiency of air. Some of these burners are contrived so that the size of the jets, from which the vapourized air escapes, may be made larger or smaller at pleasure by moving one of the walls of the aperture. It is now adjusted so as to burn white. To yield the greatest quantity of light I open the jet a little, the luminosity diminishes, and smoke begins to appear. I now contract the aperture (and you will understand that, under a given pressure, the gas will escape more rapidly into, and, therefore, will mix more perfectly with, the surrounding air, from a small hole than from a large one). You observe that as the velocity of the escape increases the light disappears, and I get a perfectly blue flame. The great heat here produced will be evident to you from the rapidity with which this piece of platinum wire becomes red hot in the flame: the heat which before was devoted to igniting the carbon is now available to any purpose to which we may wish to apply it. I open the aperture: the light again starts into play. Here is an application of this principle to blowpipe purposes. It is a brass tube terminating in a cone, at whose apex is a small round aperture; when by turning the stopcock I allow the vapourized air to escape here, and ignite it, I get a white cone of flame. I now push forward an outer larger tube (which slides on the first, and is open at both ends), so that its anterior part projects beyond the jet, which is now concealed within this second tube. I have now a blue flame, of considerable heating power, issuing from the fore end of the outer tube. The stream of vapourized air escaping from the inner jet mixes in the outer tube with a farther quantity of air, which it carries forward with it to the point of combustion, and there enters into the rapid combination which is requisite for the evolution of heat.

You will have remarked the extreme whiteness of the benzole flame when adjusted for luminosity. I stated just now that the whiteness of this, and of almost all flames, so far as they possess this quality, depends on the carbon passing through them; and the purity of this white depends on the heat being of the degree requisite to maintain the carbon at incandescence, and on the absence of other materials which would impart some monochromatic tint to the surface of illumination. A few other substances become truly incandescent—white hot—under similar conditions; but most other bodies, when in this state of minute division, confer on flame certain partial colours: many elements may be recognised by their peculiar tints of inflammation. Now, by getting rid of the excess of carbon, which gives the whiteness to our benzole flame, we may analyze, as it were, our field of ignition, or at least examine it as to the presence or absence of certain colouring matters, which infest almost all the ordinary sources of artificial light. The colour of the light thus obtained from any fuel may be called the ground tint of its flame. I must remind you that pure hydrogen is probably truly cryptogamic,—that its combustion is colourless, invisible,—and that that of carbon (I speak of its act of union with oxygen, not of its ignition) is blue, somewhat similar to that of sulphur, perhaps with more of a shade of violet. This carbon colour we see, perhaps, in the beautiful flame of carbonic oxide; the greenish tinge of this hydrogen flame arises, no doubt, from certain impurities, which pass with the gas from the jet. I wish you to infer with me that, the farther the ground tint of any luminous flame differs from blue, the less perfect is its fuel as a source of light. I now cause my benzole to burn with its maximum rapidity. I have again the blue flame, to which I just now called your attention, very similar to that of carbonic oxide. It is remarkable that the apex of its cone, when the combustion is most intense, has a sort of lavender or greyish hue, becoming sometimes almost invisible, and reminding us of the most refrangible extremity of the solar prismatic spectrum: this flame too, if examined with a prism, will be found still to contain a small proportion of red of low refrangibility; its spectrum is an extremely beautiful object. However, to our unassisted eyes, the elementary flame of benzole is almost purely blue; and I wish to illustrate the purity of it, and of the hydrocarbon itself as a light-fuel, by showing to you how small an introduction of foreign matter will confer a tinge on the whole flame. I just touch the flame at one point with a piece of glass: the entire space of combustion becomes yellow; a minute piece of fine writing paper confers on it a green tinge; a piece of cotton does the same; even a minute thread of smoke rising from one of these materials into the flame colours it entirely green. We will not stop to inquire what actual elements give rise to these tints: it is sufficient for my purpose that mere traces of them produce the effect, and that they are not rare substances unlikely to occur in connection with a light-fuel. You will see at once the green or yellow in the flame of a stearine candle, and the blushing red of the gas, when compared with the light of benzole: our experiment with the cotton may hint to you why it is that a pure white artificial light is so rarely found, and how to the beauty of wax, or even of tallow, flame justice can scarcely be rendered in a candle, though the proverbial impurity of coal-gas may make it difficult to assign the shades of colour, that are compounded in its combustion, to the various strange ingredients that travel ever through the burners.

Before leaving the subject of the inflagration of benzole I may mention an interesting property connected with it. It is well known that if a piece of spongy platinum be heated to redness, and placed in contact with the vapours of alcohol (or of certain other volatile liquids) and with air, it will cause a slow flameless combustion to ensue, which will maintain the metal in a state of rubescent heat. It has this property also with respect to benzole: I place this piece of spongy platinum at the mouth of this jet, from which there issues the mixture of air and benzole vapour; this I inflame: the little piece of metal soon becomes red hot: I blow out the flame, which does not reappear: however, you will see that the spongy platinum remains red hot, and will continue so till I stop the current, when it rapidly becomes cool again. Again, it is well known that spongy platinum will cause a jet of hydrogen, coming in contact with the air upon its surface, to take fire. It will not act thus with respect to benzole vapour; not even when red hot, as you just now observed: the hydrogen here has already possession of the carbon, which it is in no haste to relinquish, and requires the incitement of a higher temperature, such as that of a flame, to induce it to transfer its affection from its sister element to the oxygen. However, that there is, even towards the hydrocarbon, a tendency of this platinum to exert its strong propensity to match-making, will be farther evident from this experiment. If I allow the vapourized air to escape very rapidly from a small jet, it will not keep alight after being ignited; I inflame the stream issuing from this small blowpipe jet; I now increase the pressure of the air from within by farther opening the stopcock; you observe that the light is extinguished—the current has blown out its own flame. I now moderate the pressure, place the spongy platinum near the mouth of the jet as before, and ignite the gas with a taper; the platinum becomes red hot; I now fully open the stopcock so as to obtain a far greater rush of air than before, but the flame still continues burning with increased energy, and shows no inclination to disappear.

Next to its inflammability, perhaps its capability of mixing with other substances (which has already called for notice in connection with the cognate hydrocarbons, and with certain other spirits of the allied family of alcohols) is the property of benzole which chiefly invites our attention. There are, perhaps, no qualities which help us farther towards a notion of the nature of substances than their relations with other bodies in the way of solvent power or of solubility; and there are few which we have occasion, more frequently than these, to consider under the aspect of utility. My title impels me on both of these tracks, but they lie parallel and close to each other, and we may pursue them both at once, with a footing on each.

The solvent faculty implies molecular mobility; it belongs, therefore, especially to fluids and to liquids (though some solids, too, have so strong an affection for each other that they melt away on coming into contact; for instance, ice and common salt). That the true position of benzole in the kingdom of liquids may be understood, I must state, before speaking of its condition as a solvent, that among liquids there are three degrees of this power, which, with them, is that by which two or more substances may be united into one uniform liquid. First is the insaturable

* It was found that the expansion of air alone was not sufficient to move the mercury through the desired space. With ether the instrument becomes an extremely sensitive thermometer.

solution—the true force of affinity; such is that of the hydrocarbons towards each other. There is an apparent exception to (which, however, is only a particular case of) this family law; it is that which occurs when one of the parties to the solution is a fusible solid; here, however, the variation only occurs within certain limits of temperature, for it will be found that at a point below the fusing degree of the solid it will entirely dissolve in its relative, whatever be its quantity. If the substances be of the same natural family, they will not be oils to each other, as benzole is an oil to water, but will enter eagerly into perfect mixture when placed in conditions favourable to liquefaction, and may be again separated without decomposition. Second is the saturable solution in which the substance dissolved is recoverable, unchanged, by simple removal of the solvent, but is never taken into mixture in quantity greater than a certain proportion to the bulk and temperature of the solvent. Such is the relationship of the hydrocarbons with spirit of wine, of salt with water. In this case the substance to be dissolved may be either solid, liquid, or gaseous; if liquid, it stands on terms of oiliness towards the solvent in inverse proportion to the quantity which is conciliated into solution. Third is the saturable solution in which the substances combine, as in the last case, only in definite proportions, but cannot be sundered without the intervention of chemical agency. There are two distinct cases of this sort of solution; the one is that in which the substances may, by chemical means, be recovered unchanged from the combination, and this is chiefly when they are electro-polar to each other, and unite to form salts, to the decomposition of which very various degrees of force are requisite, but generally greater than the simple heat necessary for the ebullition of either of the components: the other is that in which one (or both) of the substances concerned are so changed in the solution as not to be redeemable from the state of transformation into which it has passed. Of this latter sort of union many neutral bodies may be, and among them many of the hydrocarbons are, to a remarkable extent, susceptible.

Of the first mode of solution benzole at once affords an example, in the readiness with which it will mix in all proportions with its congener oils. You cannot pour too much of any liquid hydrocarbon into it: they are all received with eagerness. Indeed it will admit almost all true oils (*i.e.*, substances consisting radically of carbon combined with certain other elements, and such that when liquid they are not soluble in water) into solution, generally insaturable. Here are solutions of camphor, mastic, olive oil, wax, stearine, gutta percha, in benzole. As a solvent for grease of all sorts it is unequalled, and its ready volatility may render it, in many instances, of extreme value as a detergent, disappearing entirely after having done its work. This tendency, combined with the peculiar properties of gutta percha, confers a remarkable utility on its solution of that substance. Here is a smooth glass plate. I spread upon this with a brush some gutta percha liquefied in benzole; in a few seconds the benzole has evaporated, leaving on the glass surface a tough film of the solid, which may be readily pecled off. Here is an artificial bladder, which has been formed in this way, by spreading the solution on the inner surface of a glass flask, from which, detaching itself as it dried, it was readily extracted. Here is another which was spread on the outer surface of a flask, which was broken, and withdrawn from within. Any smooth surface, of a substance not soluble in the hydrocarbon, will serve this purpose as well as glass. The application of this to the formation of artificial skin is obvious; nothing is necessary but to varnish the wounded surface with the solution: a sound cuticle is immediately obtained. The skin is more durable, especially on the joints and flexible parts of the body, if made in a similar way with a solution of caoutchouc in benzole, or with a mixture of this with the gutta percha liquid. The solution of indiarubber is not so readily formed, requiring longer digestion and warmth. By thus varnishing moulds of fit size and shape, we may, with the greatest rapidity, make ourselves suits of waterproof clothing of any texture, from the finest goldbeater's skin to the stoutest tarpaulin.

Instances of saturable solution are afforded by benzole in cases of sulphur and phosphorus. You see that these bodies have partly crystallized out of the liquid, having been entirely dissolved when the hydrocarbon was boiling. The crystallization of the sulphur is very remarkable, exhibiting at once the two distinct forms in which that body arranges itself: the long acicular prisms are constructed during the first stages of the process while the liquid is slowly cooling, at temperatures not far below its boiling point; the small octohedrons are formed at a later period, as the liquid approaches the ordinary temperature of the air.

The degrees of sympathy existing between different tribes of liquids are peculiarly interesting. I have already had occasion to show you that benzole is soluble in common spirit of wine and in wood spirit. These liquids are, however, reconcilable only to a certain extent. They are on terms of saturable solution; beyond a certain point they cannot agree, except to differ. Yet towards these spirits benzole is, perhaps, the most sociable of all its tribe, certainly of its coal-tar brotherhood.

Here is a series of bottles containing the hydrocarbon products, into which some purified coal-naphtha was separated by one distillation. They are mixtures of those of the neutral oils marked on the table, which boil below 200° Centigrade; each specimen will owe its chief characters to the oil whose boiling point lies nearest to the temperature at which it was actually distilled. The first fraction will consist principally of benzole, the last of cymole, with a certain quantity of naphthaline. Here are as many test-tubes containing each half an ounce of alcohol. I pour into each of these half an ounce from one of my naphtha-fractions—from each bottle some to one corresponding tube. In the first you see the oil is rapidly dissolved—the interfusion is perfect. The liquid in the second is cloudy for a moment, then on being shaken solution becomes complete. The third mixture remains cloudy; I warm it over the spirit-lamp; it becomes clear and uniform, and seems to remain so. The fourth behaves similarly, but on standing a few seconds becomes turbid, and finally deposits a small stratum of undissolved oil at bottom. Of the fifth oil there will not remain in solution more than a small quantity, even when hot. In the sixth and last tube the spirit even boiling will not take up a perceptible quantity of the naphtha, which is, to it, irreconcilably oily. Here, then, is another point in which benzole differs from some of its congeners; but even it is not unreservedly miscible with the alcohol: I pour benzole into this bottle containing alcohol; you see that the liquids continue to mix up to a certain point, the spirit (of sp. gr. .840) admitting into solution about twice its bulk of the oil: but a farther quantity of the hydrocarbon, which I pour in, sinks to the bottom. Farther, if to this perfectly clear saturated solution of benzole in alcohol I add a drop of water, some of the oil is precipitated, and by adding a sufficient quantity of water I can separate it all. The spirit of wine prefers the society of the water, and for it quits the benzole; now, benzole is perfectly oily to water; each will dissolve only a mere trace of the other—they are utterly at variance; yet you will observe that here, when I had added only sufficient water to expel half the quantity of benzole from the hydrated spirit, this water, the remaining half of the oil, and the alcohol were all together in mutual solution; the water and the oil had been cheated into intercourse by the peace-making spirit, whose nature is intermediate between theirs, having sympathy with both of them. In the same manner ether is intermediate as a solvent between alcohol and benzole. These various degrees of oiliness of liquids are extremely interesting: it appears to bear some definite relation to a peculiar state in which carbon is united with hydrogen, or with an element simulating hydrogen, in their composition.

There is a curious property of solution connected with some liquids, which belongs to benzole in relation to certain resinous substances. Copal and animé are two of this resin tribe which are very shy of solution. They are almost insoluble in most of our common oils and spirits; for instance, in liquid benzole. A very minute quantity only, of either of them, is taken up by this oil even boiling. But the vapour of the boiling hydrocarbon, if allowed to condense on the resins, will rapidly reduce them to liquidity. Here is a glass flask in which I have some benzole boiling: it is surmounted by another flask, luted mouth to mouth with the other, so that all the vapours from the lower one are conducted to the upper, in which are placed a number of pieces of copal (the upper flask is provided with a beak-tube at its top, by which any excess of vapour may distil over); you will observe that thick drops are continually trickling down from the upper vessel to the lower: thus the refractory solid is brought to solution. This is a case of saturable solution: only a certain quantity of the resin is retained in liquidity.

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LVII.

(LECTURE LXXXV.)

VEGETO-ALKALIS OR ALKALOIDS.

Under the denomination of organic alkalis or vegeto alkalis are comprehended certain proximate vegetable principles possessed of alkaline properties.

The vegeto-alkalis constitute a very numerous class of bodies. The greater number of them that are known are found in plants, where they exist in combination with acids; some of them, *e.g.*, melanine, quinoleïne, &c., are artificial products.

It is almost invariably in plants possessed of considerable medicinal properties that the vegeto alkalis have been met with; and, on the other hand, the essential properties of such plants are almost constantly found to be due to the presence of the vegeto-alkalis in them.

Nearly the whole of the vegeto-alkalis known are quaternary compounds, formed of carbon, hydrogen, nitrogen, and oxygen. Cicutina and nicotina contain no oxygen; thiosinamine numbers sulphur among its constituent elements.

The organic alkalis are almost all of them solid and crystallizable. Those alone that are volatile have any smell; the non-volatile ones are perfectly inodorous. In taste the vegeto-alkalis differ: some of them are bitter, others acrid, and others still both bitter and acrid. The salts of the vegeto-alkalis possess the taste of the alkali to a much higher degree than the insulated alkali.

Generally speaking, the organic alkalis are only sparingly soluble in water. Alcohol dissolves them readily, particularly when hot. Some of them are soluble, others insoluble, in ether. The vegeto-alkalis combine with acids, and form with them neutral salts, and salts with excess of acid. The compounds which the organic alkalis form with the hydracids contain no water; those which they form with the oxy-acids retain one equivalent of basic water, like the ammoniacal salts. Tannin precipitates solutions of the salts of the organic alkalis; the tannin forming with the latter sparingly soluble compounds. Solutions of the alkaloïd salts are precipitated also by the alkalis, the latter combining with the acid of the alkaloïd salt. The

chlorides of gold, platinum, and mercury form with the hydrochlorates of the organic alkalis very sparingly soluble compounds of various colours.

The organic alkalis are rarely prescribed in their isolated state. Custom has, however, sanctioned the administration of strychnia and brucia in this state. The other alkaloïds are given generally in the form of salts, or—and this mode of administering the vegeto-alkalis obtains more than any other—we give the plants containing them, or the pharmaceutical preparations made with these plants.

M. Tripier has proposed the endermic application of the organic alkalis in the form of soaps, oleotes or oleomargarates: the absorption of the vegeto-alkali is ensured with greater certainty in this form than where the alkaloïds are made to enter into the liniments of pomatums in the form of salts, tinctures, or extracts.

These alkaloïd soaps are prepared either by direct solution of the alkaloïds in the fatty acids, or by double decomposition.

First Method.

Decompose by means of an acid the soap of sweet almond oil or olive oil, and wash the fatty acid carefully, to free it from all adherent traces of the acid which has served as the decomposing agent. Expel the water by the application of a gentle heat in the water-bath. Take now three parts of the fatty acid, and two parts of the alkaloïd, and dissolve in the water-bath.

Second Method.

Take white soap, dissolve it in water, and saturate the solution with very dilute acetic acid, as long as the transparency of the solution continues unimpaired. Add now gradually the neutral solution of on alkaloïd salt, and operate cautiously in this, so as not to exceed the point at which the salt ceases to act on the soap. It is advisable to conduct this operation in the water-bath. The soaps of morphia should be prepared by this method alone.

The alkaloïd soap once obtained, dissolve it in the water-bath in an equal weight of olive oil or fat.

The substances which owe their properties to the vegeto-alkalis are classed most readily according to the nature of the alkaloïd which they respectively contain. We have, accordingly, the following series:—

QUINA AND CINCHONIA.
The various species of bark.

MORPHIA, CODEIA, AND NARCOTINA.
Opium,
Poppy.

STRYCHNIA AND BRUCIA.
Strychnos nux vomica,
Strychnos ignatia,
Strychnos colubrina,
Angustura spuria.

VERATRIA.
Veratrum album,
Veratrum sabadilla.

COLCHICIA.
Colchicum autumnale.

DELPHIA.
Delphinium staphisagria.

ACONITIA.
Aconitum napellus.

ANEMONIA.
Anemone pulsatilla.

ATROPIA.
Atropa belladonna.

DATURIA.
Datura stramonium.

HYOSCYAMIA.
Hyoscyamus (albus, niger, &c.).

SOLANIA.
Solanum dulcamara.

NICOTINA.
Nicotiana tabacum.

CICUTINA.
Conium maculatum.

EMETIA.
Cephælis ipecacuanha,
Chiococca racemosa.

BUXIA.
Buxus sempervirens.

PICROTOXIA.
Anamirta cocculus.

CAFFEIA.
Coffea arabica,
Thea viridis et bohea,
Paullinia sorbilis (Guarana).

QUINA AND CINCHONIA.

Quina and cinchonia (quinine and cinchonine) are the vegeto-alkalis which are contained in the several species of bark, and to the presence of which the latter owe their medicinal properties. These two alkaloïds have been found in the three officinal species of bark, viz., the pale, the yellow, and the red.

The presence of quinine has been detected since by M. Kuhlmann in a different species of bark, of which the origin remains as yet unknown. M. Coxe found both quinine and cinchonine in the Virginian bark (from Pinkneya pubens). MM. Pelletier and Caventou state that they have found quinine in combination with cinchonine in Carthagena bark (Pertlandia hexandra), associated, however, besides with some colouring matter, which renders its extraction a task of greater difficulty. Gruner has since found in the Carthagena bark a different alkali, which crystallizes in fine needles, and is much less soluble in ether than quinine; with sulphuric acid this alkali forms a salt which crystallizes in quadrangular prisms, and tastes like aloës. The saturating capacity of this alkali is greater than that of either quinine or cinchonine.

MM. Pelletier and Corriol have also found in the Cusco or Arica bark a variety of the Carthagena bark, a base which differs from quinine and cinchonine, and to which they have given the name of aricina. The distinctive characteristics of aricina is that the saturated and boiling aqueous solution of its sulphate assumes upon cooling the state of a tremulous jelly, which upon desiccation acquires a horny appearance. The alcoholic solution of sulphate of aricina, on the contrary, crystallizes in silky needles. The formula of aricina is—

$$C_{20}\ H_{12}\ N\ O_3.$$

According to Manzini, the pale bark furnished by Cinchona ovata contains a peculiar basis, to which Manzini has given the name of cinchovatine. This alkali appears to be identical with Mill's blanquinine.

According to Peretti, the Cinchona pitoxa contains a peculiar alkali, to which that chemist has given the name of pitoxine; this alkali in the isolated state has no bitter taste, which it would seem to acquire only upon entering into combination with acids.

The Cinchona nova contains a peculiar acid (kinovinic), of which the properties are so analogous to those of salsaparin that Buchner and Winckler were thereby led to confound it with the latter principle. Schnedermann has since demonstrated that the kinovinic acid and salsaparin are perfectly distinct principles. The yellow bark contains equally kinovinic acid.

QUININE.

Quinine is an energetic alkaloïd. It presents itself usually in the form of a resinous mass; but it may be obtained also in six-sided prisms. The formula of quinine is:—

$$C_{40}\ H_{24}\ N_2\ O_2.$$

The equivalent number of this alkaloïd is 412.

In the state of hydration it contains 6 equivalents of water=14.1 per cent., which it loses upon fusion.

Quinine is white, inodorous, and has a very bitter taste; it fuses readily. It is only very sparingly soluble in boiling water, and, according to Magonty, still less soluble in cold water. In water at 140° Fahrenheit it loses its hydration water. It is readily soluble in alcohol; hot alcohol dissolves a larger proportion of it than cold alcohol. It dissolves also tolerably well in ether.

It forms with acids readily crystallizable salts, of nacreous aspect. They have all of them an exceedingly bitter taste. Most of them are soluble in water, alcohol, and ether. The mineral acids precipitate the quinine from the solutions of its salts. Ammonia decomposes the quinine salts only partially in the cold, whilst, on the other hand, quinine decomposes the ammoniacal salts upon ebullition. Gallnuts precipitate the solutions of quinine salts.

Quinine is obtained usually by precipitating the solution of any of its salts with ammonia. To obtain it in the crystalline state M. Pelletier recommends to dissolve the resinous mass in alcohol of 90 Cent., and to leave the solution to spontaneous evaporation in a dry place. M. Henry proposes to dissolve the crude quinine in alcohol of 80 Cent.; to add water to the solution until the liquid commences to turn milky, and to leave it then in the open air: in a few days the portions which had precipitated at first in the form of a fluid resin will be found converted into radiated crystals. M. Magonty advises to let the quinine crystallize from water; Liebig conducts the operation in a hot ammoniacal solution.

CINCHONIA, OR CINCHONINE.

Cinchonine crystallizes readily in anhydrous quadrilateral prisms bounded by oblique facets.

The formula of cinchonine is:—

$$C_{40}\ H_{24}\ N_2\ O_2.$$

Its equivalent number is 401.

Cinchonine is colourless and inodorous; it has a bitter taste. It fuses only when on the point of decomposition. It requires 2,500 times its own weight of cold water for solution, but is a little more readily soluble in alcohol, though somewhat less so than quinine. Hot alcohol dissolves a larger proportion of it than cold alcohol. In cold ether it dissolves to a very trifling extent only. It combines readily with acids. The salts of cinchonine are bitter; they possess all the characteristic properties attributed to the quinine salts.

Cinchonine is obtained by precipitating its salts with ammonia; it crystallizes readily from alcohol.

The salts of cinchonine bear, as already stated, very considerable analogy to those of quinine; yet they may be distinguished and separated from the latter, as the alkaline bicarbonates precipitate cinchonine in presence of tartaric acid, whilst they fail to precipitate quinine under the same circumstances.—(Oppermann.)

BIRTHS AND DEATHS IN LONDON DURING THE WEEK.—The number of deaths in London during the week ending on Saturday last, according to the return of the Registrar-General, from all causes, amounts to 1,033, being an increase of 70 upon the weekly average. This is to be attributed chiefly to diseases of the respiratory organs. Only one fatal case of cholera is given; it is that of a female child aged five years, after an attack of the disease which lasted six hours. The number of births during the same week was 1,398. The mean height of the barometer was 29.498; the mean temperature of the week was 54°.9.

TABLES SHOWING THE CHEMICAL SYMBOLS, COMBINING PROPORTIONS, AND SPECIFIC GRAVITY OF THE ELEMENTARY SUBSTANCES.

ARRANGED FOR THE CHEMICAL TIMES

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Table I.

TABLE OF THE ELEMENTARY SUBSTANCES, ARRANGED ALPHABETICALLY, WITH THEIR SYMBOLS AND COMBINING PROPORTIONS, ACCORDING TO LIEBIG, BERZELIUS, AND DUMAS.

A.—METALLOIDS.

Names of Elements.	Symbols.	Equivalents. Liebig and Gregory. H=1.	Berzelius. O=100.	Dumas and Prout. H=1.
1. Boron	B	10.91	136.25	20
2. Bromine	Br	78.39	978.30	78
3. Carbon	C	6.04	76.44	6
4. Chlorine	Cl	35.47	442.65	36
5. Fluorine	F	18.74	233.80	18
6. Hydrogen	H	1.00	12.479	1
7. Iodine	I	126.57	1579.50	126
8. Nitrogen	N	14.19	177.04	14
9. Oxygen	O	8.013	100.00	8
10. Phosphorus	P	15.72	392.28	16
11. Selenium	Se	39.63	494.58	40
12. Silicon	Si	22.22	277.31	8
13. Sulphur	S	16.12	201.17	16

B.—METALS.

14. Aluminium	Al	13.72	171.17	27
15. Argentum (Silver)	Ag	108.31	1351.61	108
16. Arsenic	As	37.67	940.08	38
17. Aurum (Gold)	Au	199.2	2486.03	200
18. Barium	Ba	68.66	856.88	69
19. Bismuth	Bi	71.07	886.92	72
20. Cadmium	Cd	55.83	696.77	56
21. Calcium	Ca	20.52	256.02	20
22. Cerium	Ce	46.05	574.70	48
23. Chromium	Cr	28.19	351.82	28
24. Cobalt	Co	29.57	368.99	30
25. Cuprum (Copper)	Cu	31.71	395.70	32
26. Dydimium				
27. Ferrum (Iron)	Fe	27.18	339.21	28
28. Glucinium	G	26.54	331.26	18
29. Hydrargyrum (Quicksilver)	Hg	202.87	1265.82	200
30. Iridium	Ir	98.84	1233.50	96
31. Kalium (Potassium)	K	39.26	489.92	40
32. Lithium	L	6.44	80.33	8
33. Lanthanum	La			
34. Magnesium	Mg	12.89	158.35	12
35. Manganese	Mn	27.72	345.89	28
36. Molybdenum	Mo	47.96	598.52	48
37. Natrium (Sodium)	Na	23.31	290.90	24
38. Nickel	Ni	29.62	369.68	28
39. Niobium				
40. Osmium	Os	99.72	1244.49	100
41. Palladium	Pd	53.36	665.30	54
42. Pelopium				
43. Plumbium (Lead)	Pb	103.73	1294.50	104
44. Platinum	Pt	98.84	1233.50	99
45. Rhodium	R	52.20	651.39	52
46. Rhuthenium	Ru			
47. Stannum	Sn	58.92	735.29	58
48. Stibium (Antimony)	Sb	64.62	1612.90	65
49. Strontium	Sr	43.85	547.29	44
50. Tantalum (Columbium)	Ta	184.90	2307.43	185
51. Tellurium	Te	64.25	801.76	32
52. Thorium	Th	59.83	744.90	60
53. Titanium	Ti	24.33	303.66	24
54. Vanadium	V	68 66	856.89	68
55. Uranium	U	217.26	2711.36	61
56. Wolfram (Tungsten)	W	99.70	1183.00	100
57. Yttrium	Y	32 25	402.51	32
58. Zinc	Zn	32.31	403.23	32
59. Zirconium	Zr	33.67	420.20	32

Table II.

SPECIFIC GRAVITY OF ELEMENTARY SUBSTANCES.

A.—Gases.

	H = 1.
Oxygen	16
Nitrogen	14
Chlorine	36
Hydrogen	1

A.—Glass.

	Air = 1.
Oxygen	1.111
Nitrogen	0 972
Chlorine	2 470
Hydrogen	0.0694

B.—Liquid and Solid Elements.

Water = 1.

Antimony	6.712
Arsenic	5.8 to 5.9
Bismuth	9.822
Bromine	2.99
Cadmium	8.60 to 8.69
Carbon (Diamond)	3.4 to 3.6
Chromium	5.9
Cobalt	7.8 to 8.7
Columbium	6.0
Copper	8.66 to 8.89
Gold	19.3
Iodine	4.8 to 4.9
Iridium	18.0 to 26.0
Iron	7.7 to 7.8
Lead	11.35 to 11.44
Manganese	8.01
Mercury { Fluid	13.54
Mercury { Solid	15.61
Molybdenum	7.4
Nickel	8.27 to 9.0
Osmium	10
Palladium	11.2 to 11.86
Phosphorus	1.77
Platinum	21.2 to 21.5
Potassium	0.865
Rhodium	11.0
Selenium	4.32
Silver	10.4 to 10.6
Sodium	0.972
Sulphur	1.99 to 2.08
Tellurium	6.3
Tin	7.2 to 7.6
Titanium	5.3
Tungsten	17.4
Zinc	6.8 to 7.2

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON SOME NEWLY-DISCOVERED SUBSTANCES FROM THE AFRICAN GUANO DEPOSITS.

By THORNTON J. HERAPATH, Esq.*

Some time in the latter part of the year 1845 a paper was read before this society by Mr. E. F. Teschemacher,† in which the author gives an account of the results of his analyses, including a variety of substances which had been found in the guano deposits and in their vicinity. Besides those there described, however, I have lately had the opportunity of examining another, which that gentleman does not appear to have taken any notice of. This substance, which was found occurring in large crystalline masses or nodules in a cargo of guano from the island of Ichaboe, on the western coast of Africa, was sent to my father's laboratory for examination, by Mr. Ruxton, of Swansea, in January, 1846, some of the parties to whom he had supplied the guano having complained to him of the presence of the crystals, imagining them to be an adulteration. These crystals, when purified from the adherent guano, were found to be perfectly transparent and homogeneous, but stained of a light yellowish-brown colour by the humic acid and extractive matters of the guano. They were exceedingly frangible, and did not effloresce upon exposure to the air; they dissolved easily both in hot and cold water, and the solutions gave with the soluble salts of silver a bright yellow precipitate, which was almost entirely soluble in an excess of nitric acid. When boiled with a solution of potassa, pungent fumes of ammonia were given off, which gave a fugitive stain to moistened turmeric paper. Before the blowpipe they intumesced, turned black, and gave off water and ammonia; by a further application of heat the carbonaceous

* From "The Quarterly Journal of the Chemical Society of London," vol. ii., having been read January 15; and now communicated to the *Chemical Times* by the author.

† Mem. Chem. Soc., vol. iii., part 16, p. 13.

matters were burnt off, and the residue fused into a transparent colourless glass, which dissolved readily in boiling water, giving a solution which yielded a granular precipitate when tested with antimoniate of potash.

The specific gravity of these crystals, as determined by means of oil of turpentine, was about 1.6151. An attempt was made to ascertain the primary form of the crystal, but it was found impossible to do so from the rough irregular masses met with in the guano. By dissolving these, however, in boiling water, and filtering the solution and crystallizing, the salt was obtained in moderately large, colourless, prismatic crystals. Upon subjecting these to analysis, the following results were obtained :—

I. 10 grains of the salt, when heated to redness, lost 5.103 grs. of water and ammonia.

II. 10 grains, when treated as before, lost 5.243 grs. in weight.

III. 5 grains, when burnt with potash and lime by Varrentrapp and Will's process, gave 4.890 grs. of ammonio-chloride of platinum = 0.377 gr. of ammonia.

IV. 5 grains, treated as before, gave 5.078 grs. of ammonio-chloride of platinum = 0.391 gr. of ammonia.

V. 10 grains, when dissolved in water, and the solution precipitated by neutral acetate of lead, gave 20.331 grs. of phosphate of lead, which, when decomposed by sulphuric acid, gave 22.938 grs. of sulphate of lead.

VI. 10 grains, treated as before, gave 19.549 grs. of phosphate, and 21.867 grs. of sulphate, of lead.

VII. 10 grains gave 3.002 grs. of chloride of sodium.

VIII. 10 grains gave 2 905 grs. of chloride of sodium.

These numbers give the following per-centage composition :—

	I.	II.	III.	IV.	V.
$\dot{P}$			..	..	34.291
$\dot{N}a$			..	..	..
NH_3	51.030	52.320	7.504	7.820	..
$\dot{H}$			..	..	..

	VI.	VII.	VIII.	Mean.
$\dot{P}$	34.360	..	..	34.325
$\dot{N}a$	..	16.010	15.494	15.752
NH_3	..	..	..	7.680
$\dot{H}$	..	..	..	42.243

which very closely corresponds with that of the ammonio-phosphate of soda, or microcosmic salt, the formula for which is :—

$$\dot{N}a, NH_3, \dot{P}h + 10\dot{H},$$

or, according to Graham,

$$NaO, NH_4O, PO_5, HO + 8HO.$$

The original crystals contained the following constituents in 100 parts as :—

Crystallized ammonio-phosphate of soda	91.660
Organic matters (urates, humates, &c.)	1.956
Phosphate of potash	evident traces
Chloride of sodium	0.521
Carbonate of lime	0.280
Carbonate of magnesia	traces
Phosphate of lime	2.100
Silica, sand, &c.	2.151
Water and loss	1.332
	100.000

With regard to the manner of the formation of this salt, it is extremely difficult to comprehend how such a compound as the ammonio-phosphate of soda could be produced by the decomposition of a substance so remarkably deficient in the alkalis as guano. For, unless we can conceive that there was in this case a peculiar and special source of the soda, we must of necessity admit that it was obtained from the decomposition of the chloride of sodium of the sea water by the phosphate of ammonia of the guano, the resulting chloride of ammonium being either volatilized at the high temperature of those climates, or, from its extreme solubility, dissolved out by the rain water and carried into the sea or the lower strata of the guano deposits. We well know that chloride of sodium is capable of being decomposed by phosphate of ammonia at a high temperature. May not this decomposition, therefore, also take place when the salts are in solution? I think it very probable.

This being the first instance in which the ammonio-phosphate of soda has been met with as a natural production, I propose to class it amongst our minerals under the name of "Stercorite."* I should have preferred to have given it that of Guanite, as being more indicative of its origin, but this has been already applied by Mr. Teschemacher to the ammonio-magnesian phosphate, another product of the decomposition of guano.

I have also examined another salt which was met with in the same cargo of guano as the preceding, to which it bore a very close resemblance, both in physical and chemical properties. Like it, it was frangible, crystalline, and readily soluble in water, and gave off ammoniacal fumes when heated to redness or when treated with caustic potash; it also gave a yellow precipitate with nitrate of silver; but it differed from it in effloresing upon exposure to the air, and in not giving a precipitate with antimoniate of potash.

The primary form of the crystal, as nearly as could be determined from the few imperfect specimens in my possession, was an oblique rhomboidal prism, with a dihedral summit. Upon redissolving these in water, and recrystallizing by spontaneous evaporation, long acicular crystals were obtained, which, when dried between pieces of bibulous paper and subjected to analysis, afforded the following results :—

I. 2.131 grains of the crystals, when heated to redness, lost 1.034 gr. in weight of water and ammonia.

II. 1.940 grain gave 6 039 grs. of ammonio-chloride of platinum = 0.465 gr. of ammonia.

III. 3.500 grains gave 10.539 grs. of phosphate of lead, which gave 11.786 grs. of sulphate of lead = 1.854 gr. of phosphoric acid.

Or, in 100 parts :—

		I.	II.	III.	
Water	48.521	..	..	23.058	
Ammonia		23.980	..	23.980	
Phosphoric acid	..	..	52.962	52.962	

numbers which are very nearly equivalent to 1 atom of ammonia, 1 atom of phosphoric acid, and 1½ atom of water.† It may, therefore, be considered as the neutral phosphate of ammonia. The excess of water was doubtlessly caused by the moisture which remained between the interstices of the crystals. It was therefore the same salt as that which had been previously examined by Mr. Teschemacher, but which he was prevented from analyzing quantitatively on account of the smallness of the quantity in his possession.

In conclusion, I should perhaps observe that the guano from which the above substances were obtained was exceedingly moist, and possessed a very strong ammoniacal smell.

ON BRICKS WHICH FLOAT ON WATER LIKE CORK, AND THEIR USEFUL PRACTICAL APPLICATION.

By M. EHRENBERG.

The historian Posidonius, and subsequently Strabo, report that there existed in Spain an aluminous earth used for polishing silver, and from which bricks were formed, which floated on water. Vitruvius Pollio, the Roman architect, speaks of these stones, recommending them as a peculiarly appropriate material for building, on account of their lightness. Pliny also mentions a pumice-like earth as possessing these properties.

In the year 1791 an Italian, Giovani Fabroni, renewed the subject, and enlarged our knowledge on this matter by making the experiment of forming bricks from a siliceous earth which occurs near Santifiore, in Tuscany; and, indeed, he succeeded in forming bricks of such lightness that they floated on water. They also united well with mortar, and completely resisted the softening effects of water. These bricks were such bad conductors of heat that they might be held by one end in the hand while the other was red hot. He made a further experiment, by constructing a quadrangular cage of these bricks, on an old vessel, and filled it with gunpowder. The vessel was then set fire to, which burned until the bottom of the powder magazine was consumed, with the whole of the wood, when the latter went down, without causing the ignition of the powder. His treatise, "Di una singolarissima specie di Mattoni," was read in the Academy at Florence, and printed in several Italian periodicals and other publications.

At that time M. Faujas likewise observed a peculiar species of earth near Coiron, in France, not far from the Rhone; and Fabroni, when present at Paris, found that this latter had precisely the same properties as the mountain dust which he employed in Italy for the purpose of forming the before-mentioned light bricks. M. Faujas was, therefore, directed by the Minister of War to submit this earth, and the spot where it occurred, to repeated and close examinations. It has, however, for some reasons to us unknown, never come into general use. In the year 1832 the Count François de Nantes reminded his countrymen of the discovery of Fabroni through the medium of the "Journal des Connaissances," adding, "It is much to be wished that in France this substance should be sought for and discovered. It is white, pulverulent, and well known in Tuscany under the name of 'fossil flour.' With this dust they make unalterable and ever-durable tiles which swim on the water, and I can even produce some which have been made these 2,000 years." In consequence of this, M. Tournet, of Lyons, published in the same year a paper entitled "Notice on the Gelatinous Silica of Ceyssat, near the Pont-Gibaut, department of Puy de Dôme, and on its Employment in the Arts," and in which he demonstrated the analogy of this earth with the Italian, and confirmed Fabroni's statement regarding its properties, technical utility, and importance. M. Tournet found that bricks formed of this earth, and baked, may easily be divided with a knife; and, therefore, may well serve to make moulds for casting metal, since the cast may easily be detached, and the moulds made of any size. He further recommends this siliceous earth for use in glassworks, instead of sand, as it saves fuel; and also for porous cooling-vessels in hot climates, as they may easily be purified by heating to redness. Coated with tallow or wax, the Ceyssat stones float on the water. He further adds, "It will easily be perceived what great advantages so light a substance may yield to the navy. The powder magazine, the kitchen, the hearths of steam-engines, places where spirits are kept, and those where red hot balls might by any possibility enter, may be secured by them. It is of equal importance for the arched roofs of melting furnaces, and all furnaces where a high temperature is required, as the bricks do not melt, and contract only very slightly."

Afterwards Count Montlosier also found this earth on his estate of Prandamme; and Signor Leopoldo Pelli Fabroni, at Florence, in the year 1838, directed the attention of the public again to the application of these stones for preventing fires. Besides this, it appears that the same material has been for a long time used in Greece, as the royal collection of minerals at Berlin contains a quantity of this mountain flour, from

* From the Latin, "Stercoro," to dung or manure land.

† [Adopting Brande's views, or of $2NH_4O, PO_5, HO$, according to those of Professor Graham.]—*Note since added by the author.*

the collection of the late chemist Klaproth, labelled — Plakophourno, obviously signifying "furnace mortar." This species of earth was generally considered as inorganic, and, being discovered only fortuitously, its technical use could not extend very far.

M. Ehrenberg has in his possession the most renowned of these different earths of Italy, France, and Greece, and for several years has been occupied in submitting them to rigid examination. He communicated, in the year 1836, to the academy that the earths from Santafiore, Ceyssat, and Zante, owe their peculiarities to the fact of their being an accumulation of small siliceous shells, from invisible infusoria. The recent progress in the knowledge of the influence of infusoria directed his attention to their technical application; and, as the utility of the infusorian clay has been recommended by many practical men, the writer thinks it proper to advert to the occasion which arises in Berlin, as well as that which may probably occur in all the subfluvial basins and low shores of Germany, and perhaps of other countries, to examine this clay in a scientific manner, with a view to its practical application.

The very thick layer of infusoria underneath the houses of Berlin, on the borders of the Spree, is, when recently dug out, of a silver grey; when dry it looks white, like pipeclay; it is of the same quality as the Italian and the French, but is considerably thicker and more extensive.

With the kind assistance of the director of the Royal Porcelain Manufactory of Berlin, M. Trick, the writer caused some bricks to be prepared, samples of which he presented to the academy. A common brick weighs from seven to eight pounds and upwards; a brick from the Berlin infusoria clay weighs less than two pounds. Coated with wax, it floats on water like cork. The strongest fire of a porcelain furnace does not melt the bricks, and only contracts them slightly. By the addition of some clay or loam their solidity becomes equal, perhaps even superior, to that of common bricks, whilst their weight is not increased to half their density. Their further use for polishing, moulding, lining fireplaces, especially those which are exposed to a strong heat; for fireproof walls between houses; for constructing stone fireproof rooms, or foundations in vessels; or for vaults and covers inside buildings which are required to be of moderate weight, may perhaps soon bring them into use, to a certain extent, in Germany, Sweden, Finland, and the north of America, if judiciously applied.

ON EDIBLE BIRDS' NESTS.*

By ED. BLYTH, Esq.,
Curator of the Asiatic Society's Museum.

[*From the Pharmaceutical Journal.*]

Genus Collocalia, G. R. Gray (Swiftlets).—These are true Cypseli in structure, but comparatively feeble, having the first quill shorter than the second, and the wings and tail broad, the tail especially much resembling that of a hummingbird, with its feathers of even length, or nearly so. The feet and naked tarsi resemble those of Acanthylis, having the hind toe well opposed; but are comparatively slender, though of proportionate strength to the rest of the conformation. The breast-bone and its ridge remain incompletely ossified. Not more than three species appear to be known, though perhaps others require discrimination; they are of small or minute size, and are confined in their geographic distribution to the Indian, Indo-Chinese, and Austral-Asian countries, as far as New Guinea. Certain (if not all) of them produce the valued "edible nests" of commerce.

"In Java," remarks Sir Stamford Raffles, "these birds not only abound amongst the cliffs and caverns of the south coast of the island, but inhabit the fissures and caverns of several of the mountains and hills in the interior of the country. From every observation which has been made in Java it has been inferred that the mucilaginous substance of which the nests are formed is not, as has been generally supposed, obtained from the ocean. The birds, it is true, generally inhabit the caverns in the vicinity of the sea, as agreeing best with their habits, and affording them the most convenient retreats for attaching their nests to; but several caverns are found inland, at a distance of forty or fifty miles from the sea, containing nests similar to those on the shore.* From many of their retreats along the southern coast they have been observed to take their flight in an inland direction towards the pools, lakes, and extensive marshes covered with stagnant water, as affording them abundance of their food, which consists of flies, musquitoes, gnats, and small insects of every description. The sea that washes the foot of the cliffs, where they most abound, is almost always in a state of the most violent agitation, and affords none of those substances which have been supposed to constitute the food of the 'esculent swallow.' Another species of swallow [swift?] on this island forms a nest, in which grass or moss, &c., are merely agglutinated by a substance exactly similar to that of which exclusively the edible nests consist. This substance, from whatever part of these regions the nests be derived, is essentially uniform, differing only in the colour, according to the relative age of the nests. It exhibits none of those diversities which might be expected if it were collected casually (like the mud employed by Hirundo urbica, and the materials commonly employed in nest-making), and applied to the rocks. If it consisted of the substances usually supposed, it would be putrescent and diversified.

"Dr. Horsfield," continues Sir S. Raffles, "thinks that it is an animal elaboration, perhaps a kind of secretion;"† and Sir Everard Home, after examining the stomach of one of these birds, pronounced his decided opinion that the edible nests are composed of a substance secreted by the glands of that organ.‡ M. Poivre, who, in his often-quoted communication to Montbeillard (Buffon's "Hist. Nat. Ois.," vi., 688 *et seq.*), advocated the exploded notion that the substance was collected from the sea, remarks that there have been seen threads of this viscous matter hanging from the bills of these birds; and that it is believed, though without any foundation, they were derived from the stomach during the nesting season. M. Hooyman long ago (1781) was of opinion that the substance of them has nothing to do with sea-foam, but is elaborated from the food of the bird."* The Rev. J. Barbe adds, to his account of the nests gathered in the Nicobars, &c., quoted in the sequel, that—"The Chinese say that when the nest is taken before it is completed the bird makes another, but of an inferior quality; and it appears that it exhausts itself in building the second, the nest being spotted with blood."† The prevalent opinion is that the substance is secreted by the salivary glands; but though, on carefully dissecting a specimen of C. fuciphaga, killed when there is reason to suppose that it had young (and, therefore, too late in the season), no remarkable development either of the salivary or of the proventricular glands was apparent, yet we are fully convinced that it is secreted by the latter, from examination of other Cypselidæ; even in Cypselus balasiensis, which employs so little mucus, which is laid on merely to make its nest adhere, we have detected *in situ* stringy clots of it, while the proventricular glands were adequately developed for its production. The animal origin of the edible nests is at once detected by simply burning a bit of one; and Mr. Laidlay informed us that upon analysis he found the constituent elements to be those of inspissated saliva.‡ Looking to a number of them, and more particularly to their under surface, the quantity laid on by the bird at each time, in successive layers to the rim, is in many conspicuously apparent, and this quantity is much more than the salivary glands could well be supposed to elaborate. Each addition consists of a linear collop continued along the whole semicircular rim of the nest, which latter forms generally a shallow saucer, imperfect where affixed to the rock, and when completed having the place of attachment on either side much thickened. It is evidently in a very viscid state when laid on, adhesive at first, ductile and tenacious while drying; so that on the upper surface threads of it are pulled forth by the bird, and more or less crossed into a kind of network, as if to bind together the vertical layers, some of which are often partially unadherent. These threads, however, consist of a little additional matter to that originally laid on in the successive marginal deposits. Mr. G. R. Gray writes:—"The formation of the nest differs with the species. Some appear to be formed of flakes or threads cemented together, making an almost

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* [Mr. Blyth's interesting paper is contained in an unpublished and undated specimen of "A Plan of an Indian Ornithology," kindly lent by Dr. Horsfield, with whose permission it is reprinted in "The Pharmaceutical Journal."—J. P.]

* See also Hooyman, in "The Batavian Transactions," iii., 95; likewise Marsden; and Sir G. Staunton, in his narrative of the Earl of Macartney's embassy to China; while Mr. G. R. Gray relates (rather as if a novelty), on the authority of Mr. Hugh Cuming, that in the Philippines the nests are found inland to the distance of fifty or sixty miles. One species has in India been only observed hitherto in the mountains of the interior, at a distance of many hundred miles from the sea. According to Mynheer Hooyman, however, the nests (even of the same species) vary somewhat in quality in different neighbourhoods. Thus, of those obtained in two inland localities, not very far apart, and but a few hours' journey distant from Batavia, he states that the produce of one of these places is at least a third less valuable than that of the other, which latter is in its turn reckoned very inferior in quality to the nests gathered at Ternate and other islands, chiefly to the eastward of Borneo. These last, however, we suspect are not the produce of the same species.

† "History of Java," i., 51.

‡ Home, as cited in Griffith's "Animal Kingdom," vii., 98. [Sir Everard Home's paper, entitled "Some Account of the Nests of the Java Swallow, and of the Glands that Secrete the Mucus of which they are Composed," was published in the "Phil. Trans." for 1817, p. 332.—J. P.]

* "Bataviaasch Genootschap," iii., 97.

† J. A. S., xv., 363.

‡ J. A. S., xiv., 543. "Upon this supposition, however," Mr. Laidlay has since added, "I do not see how it could be deposited in the form of layers, as it is. The mechanical structure of the nest may be very nicely exposed by soaking it for a few hours in rain-water."

[The edible birds' nests have been examined chemically in 1814 by Döbereiner (Schweigger's "Journ. für Chemie u. Physik," Bd. xi., S. 303, 1814), in 1817 by Professor Brande (see Home's paper before quoted), and in 1838 by Mulder ("Pharmaceutisches Central Blatt" für 1839, S. 320). In Schweigger's "Journ.," Bd. xxii., S. 259, Brande's analysis is erroneously stated to have been made by Marcet, and this error has even crept into Leopold Gmelin's usually most accurate "Handbuch d. Theoret. Chemie," Bd. ii., Abt. ii., S. 1459, 1829. All the analysists agree that the substance of the nest is of an animal nature. Mulder examined a nest brought from Java by Blume; he found its composition to be as follows:—90.26 neossin (a new substance whose composition is represented by the formula $C_{11}\ H_{17}\ N_4\ O_2$), 0.53 of an animal calcareous salt soluble in water but insoluble in alcohol, 0.22 of a white solid fat, 0.77 of sulphate of soda, 3.47 of chloride of sodium with traces of chloride of magnesium, 4.75 of phosphate of lime and phosphate of magnesia, and traces of carbonate of lime and carbonate of soda.—J. P.]

solid nest; others are composed entirely of viscous matter. The exterior exhibits many nearly straight threads, which incline or are attached to each other; strengthened in front by some few short pieces of slender sticks" (this we have never seen). "The interior, which is rather shallow, shows many layers of irregular network, formed of a multitude of threads that cross and recross each other in every direction."

When newly formed these nests are perfectly clean, of a yellowish-white colour, and wholly soluble in water; but when old they become deeply soiled and mixed with feathers, and their value is immensely deteriorated. Hence, as Marsden remarks, "they are distinguished into white and black, of which the first are by far the more scarce and valuable, being found in the proportion of one only to twenty-five. The white sort sells in China at the rate of 1,000 to 1,500 dollars the picul* (according to the "Batav. Trans." for nearly its weight in silver); the black is usually disposed of at Batavia, at about twenty or thirty dollars for the same weight, where I understand it is converted chiefly into glue. * * * When the natives prepare to take the nests, they enter the caves with torches, and forming ladders of bamboos, notched according to the usual mode, they ascend and pull down the nests, which adhere in numbers together from the sides and top of the rock. I was informed that the more regularly the cave is thus stripped, the greater proportion of white nests they were sure to find, and that on this experience they often make a practice of beating down and destroying the old nests in larger quantities than they trouble themselves to carry away, in order that they may find white nests the next season in their room." According to Herr Hooyman, the C. nidifica is about two months preparing its nest, and lays two eggs, which are hatched in fifteen or sixteen days; and of a species which would appear to be C. fuciphaga, M. Poivre informs us that each of the nests which he observed contained two or three eggs or young; Sir G. Staunton, of doubtless the same species, asserts that it lays two white eggs.

The nests of the Collocaliæ are placed against the sides and roofs of deep caverns of chiefly limestone rocks, at distances from the entrance varying from fifty to several hundred feet. Wherever (as we have seen) these caves occur, whether inland or in cliffs overhanging the sea, the birds resort to them alike in prodigious numbers, building commonly, in successive layers, many nests together; but always where the cavern is perfectly dry, for obvious reasons. Every fitting site is usually crowded with the nests. The entrance to the cavern may be large, or so small as barely to admit the birds and their bat-companions; and inland the rocks are sometimes clad externally with dense jungle. At break of day the birds issue forth with a great rush, at which time the kites (Haliastur pondicerianus?) commit much havoc among them (being therefore destroyed by the Javanese and others); and in fine dry weather they fly very high, like the rest of the group, rising till they are out of sight; and low in rainy weather; returning early in the afternoon direct to their cavern, from which they do not again issue till the following morning. Most of these details are gathered from M. Hooyman's paper on C. nidifica.

The Rev. J. Barbe remarks, of the nests of C. fuciphaga gathered at the Nicobars, at Mergui, &c., that "They are of six qualities: the first, of a fine whitish colour, is obtained by taking the nest before the swift has laid its eggs. This quality is sold at Penang from 40 to 50 dollars the katee" (!) "The second quality, of a brownish colour, is obtained by taking the nest when the bird has laid her eggs. This quality is sold at Penang from 20 to 30 dollars the katee. The third quality is of a dark colour, mixed with blood and feathers, being obtained by taking the nests when the young birds have flown; the price of this is very low." The gradual exhaustion of the bird, according to Mr. Barbe's information, has been already cited. "The manner in which the Chinamen prepare the nest," continues the same gentleman, "is to steep it in water during one night; then with great trouble they clean it: this being done, they boil it in water, to which they have added some sugar-candy, till the whole forms a jelly: one nest prepared in this manner is enough for one person.*

[*To be continued.*]

* 133⅓ lbs. avoirdupois. The current price in China at this time is 18 dollars and upwards per catty of 1 lb. 5⅓ oz., or $\frac{1}{100}$ picul; *i.e.*, £4 10s. 8d. per lb., reckoning the dollar at 4s. 3d.

ON THE ANALYSIS OF THE ASHES OF ORGANIC SUBSTANCES.

By M. FLEITMANN.

Every one occupied with the analysis of ashes knows the difficulties which accompany the incineration of many substances. The escape of alkaline chlorides during the process is known to be great. Other salts are driven off or altered, especially the phosphates, which are reduced by charcoal at the high temperature necessary for combustion. Starting with the supposition that the principal cause of the difficulty of burning the charred masses arises from the envelope of fusible salts, which exclude the free access of air, I tried to improve the process by obstructing that influence. I succeeded in this by charring the substance, powdering, moistening with bichloride of platinum, and igniting the whole in the open air. In this manner the entire substance became penetrated with a fine network of platinum sponge. The well-known property of platinum sponge of absorbing oxygen in its pores, and transferring it to combustible bodies, is here of great avail. This property shows itself in so striking a manner that frequently the charcoal prepared with platinum as indicated, when once lighted, continues in a state of ignition for hours without the application of external heat. The maximum quantity of platinum is half a gramme for ten grammes of charred substance. The separation of the platinum from the ashes is simple; one difficulty has to be overcome. In most cases, where the charred substance is incorporated with the solution of chloride of platinum, a quantity of double salts of platinum is formed, which cannot be perfectly decomposed by simple ignition. A reduction by means of hydrogen is, therefore, unavoidable.

The determination of the chlorine contained in the ashes is of course to be made beforehand. The substance is to be charred in a well-closed Hessian crucible, then completely extracted with water, and the chlorine determined from that solution. In my analyses I used to analyze this solution by itself. I then proceeded to extract with hydrochloric acid, and analyzed this solution separately and also the residue. I did this at the request of Professor Rose, who has founded on these results a theory which he will soon publish.

I give below the result of my analysis of the fæces and urine of man, which I have tried to make interesting by enabling a comparison to be made between the inorganic matters they contain and those contained in the food at the same time.

I carefully collected for four days the solid and liquid excrements of a young man. The sum of the constituents in both can without doubt be regarded as equivalent to the corresponding quantities in the food. The following quantities are calculated for the period of twenty-four hours:—

	The fæces of one day contain		The urine of one day contains	
NaCl...	=0.0167	gramme	=8.9243	grammes.
NaO ...	0.0185	"		
KCl ...	...		0.7511	"
KO ...	0.5455	"	2.4823	"
CaO ...	0.5566	"	0.2245	"
MgO ...	0.2781	"	0.2415	"
Fe_2 O_3	0.0544	"	0.0048	"
PO_5 ...	0 8072	"	1.7598	"
SO_3 ...	0.0293	"	0.3864	"
SiO_3 ...	0.0375	"	0 0691	"
	2.3438		14.8438	

The difference in the proportions of potash and soda in the fæces and urine is remarkable. The quantity of soda in the fæces is in no proportion to that which is secreted daily in the body as bile, and shows that the bile must be removed from the body by some other way than the fæces.—*Silliman's Journal*, March, 1849.

* "Birds' nests being very dear," he further continues, "the wealthy Chinamen only can obtain this delicacy. The rich opium-smokers take in the morning a cup of it, for the purpose of refreshing and strengthening their debilitated frames. Persons attacked by consumption are advised by the Chinese practitioners to take these nests; they prescribe the same to those who are reduced by a protracted illness; and I have seen several persons who, having made use of this remedy, declared that they found a temporary relief from this refreshing and nourishing food." —*Journ. A. Society*, xv., 363.

THE CHEMICAL TIMES.

SATURDAY, MAY 26, 1849.

THE MEDICAL PROTECTION SOCIETY AND THE CHEMISTS AND DRUGGISTS.

In another part of our columns will be found a *verbatim* report of the address read by a Mr. Breary before the members of the Medical Protection Society, at a meeting of that body held, on the 26th of March, at the Freemasons' Tavern, Great Queen-street. We recommend to our readers a careful and attentive perusal of this address: much valuable information may be gleaned from it. So it would appear, *inter alia*, that the *speculative* individual who *founded* the Medical Protection Society has not as yet realized his actual expenses "out of pocket"; and that the expenses incurred during the short period of nine months (viz., from the 1st of July, 1848, up to the end of March, 1849) have amounted to the good round sum of *fifteen hundred* pounds, which Mr. Breary, elated, no doubt, with the successful onslaught on Dr. Lobo, ventures to predict will be amply repaid from the "fines and costs" to be recovered during the yet remaining three months of the first year of the society's existence. This prediction was made on the 26th of March; the society were then in high feather. Mr. Griffits (with the aid of Mr. Sergeant Heath) had opened to the dazzled view of Mr. Breary and his associates a long and brilliant vista of successful prosecutions, terminating finally in the utter discomfiture of physicians, surgeons, and chemists and druggists, and in the glorious advent of "pure apothecarism" to the undivided sway over the "invalids" of Great Britain.

To commence the realization of their brilliant dreams, an *experimental* action was brought against a chemist (Mr. Wells). In the conduct of this case Mr. Griffits evinced a vast amount of legal *ingenuity*, but, alas! to no purpose; the case failed, the defendant got his costs, and the *managers* of the Medical Protection Society were thus made painfully aware of the fact that Mr. Griffits had taken *rather* too sanguine a view of the extent of the powers that might be exercised under the act of 1815. Whether this failure has perchance taught the

society to be somewhat less rash in their "future" onslaughts we know not; this much appears certain, however, that the "fifteen hundred pounds" have not yet returned to the treasury of that estimable body, nor will they ever if the chemists and druggists will but bestir themselves, and resolve to combat and defeat by a *combination* of their own the miserable attacks with which they are threatened on the part of this iniquitous *conspiracy*.

We join with our correspondent "Justitia" in the advice that a public meeting of chemists and druggists be called as speedily as possible, to devise effective measures against the proceedings which the Medical Protection Society may deem fit to take against any individual member of the body of chemists and druggists. We hope, with our correspondent, that the wise and prudent will need no further incitement to combine for mutual defence and protection; and that they will clearly see and understand that their pecuniary contributions to a protection fund will, in effect, amount to a premium on an insurance against annoyance, persecution, and loss, and, perchance, absolute ruin.

SOCIETY OF ARTS.—Session XCV.

At the meeting of April 18th, 1849, Mr. F. Pellatt read a paper on the supposed influence of oxygen on the colour or tint of flint glass.

The author, in commencing his paper, stated that the remarks contained in the same are entirely the result of experience in the manufacture of glass in large quantities, it being only under such circumstances that many of the changes there noticed can be observed, because they are so minute that, in dealing with small quantities, their occurrence would pass unperceived. The term *white glass* is comparative only, as no glass is perfectly colourless; and, to the practised eye of the glassmaker, there exist no two pieces of the same tint or shade. The word *colour* is, therefore, used to denote that particular tint or shade, whatever it be, which all white, transparent glass possesses. After these introductory remarks the author proceeded to consider the action of oxygen as affecting the colour of flint glass in two distinct particulars: first, its action upon the glass mixture during its melting or founding, and whilst in a state of fusion; and, secondly, during its annealing or gradual cooling.

The constituents of flint glass are silica, lead, carbonate of potass, and nitrate of potass. The silica is found sufficiently pure as fine sand, which abounds in various districts; that from Allum Bay, Isle of Wight, is much esteemed. The lead is used in the state of protoxide (litharge), or deutoxide (red lead); the potass is the ordinary carbonate and nitrate of potass of commerce. These, when mixed in certain proportions, and subjected to a strong heat for sixty or seventy hours, produce flint glass. The purer the metal the more transparent the glass; yet, although all the materials be chemically pure, a colourless glass is not the product, but, owing to some chemical change which takes place during the melting, the glass is tinted with green. This is generally stated to arise from the presence of oxide of iron, but the author believes that, in most instances, it is owing to the want of a necessary proportion of oxygen in the mixture, which the following experience will go far to prove.

The tint of green is always least when the lead in the glass mixture is in the highest state of oxygenation—that is, when red lead is used—and deepest when litharge is employed in the mixture. When an excess of carbonate of potass is used the green tint is deep; but this green may be entirely overcome by the use of nitrate of potass. and superseded by a purple tint when no metal but lead is present.

Oxygen being the agent by which these changes in the colour of glass are effected, the glassmaker, in order to overcome the green tint, which is always present when the proportion of oxygen is small, uses the oxide of manganese, which has the property of giving off its oxygen very slowly. An excess of manganese gives to glass a purple tint, and, where altogether absent, the glass is always green. Among glassmakers the terms used to denote these tints are "high" and "low"—*high* designating purple, and *low* green.

When the glass is of a purple tint, owing to an excess of manganese, the glassmaker deoxidizes the mass by polling or thrusting a green stick to the bottom of the pot, and allowing it to remain there until sufficient oxygen has been taken up, when the purple tint will have disappeared. During the operation of polling gas may be seen brightly burning upon the surface of the glass.

The black or amber colour in glass is due to the presence of carbon, which combines with the lead and iron in the glass; but if oxide of manganese is added the dark amber colour disappears, and a beautiful light green takes its place. Where the oxygen and carbon in the mass is evenly held, the glass at first appears of a bright green, but upon a more lengthened exposure to the heat of the furnace the green tint disappears, and the amber colour is reproduced. The greater the amount of heat to which the materials are to be exposed, the greater the quantity of manganese required. During the first few hours that the glass mixture is exposed to the action of the fire no change takes place, owing to the heat being insufficient to drive off the oxygen from the manganese, and the mass appears semi-opaque and milk-white. As soon, however, as the oxygen begins to be evolved from the manganese, a bright deep purple is given to the mass. This colour gradually becomes lessened in intensity as the heat is increased, until the glass is fit to be manufactured.

The affinity of flint glass for oxygen is probably due to the quantity of lead which enters into its composition, the lead alone being acted on when oxygen is abstracted, as is proved by introducing coal-smoke over the surface of the fluid flint glass: the carbon of the smoke takes the place of oxygen, the lead is reduced to the metallic state, and, by its density, sinks to the bottom of the crucible, and the glass in contact with the smoke is found to have assumed a green colour. Where coal is employed, to prevent the smoke acting on the glass, covered crucibles are made use of.

Where lead only is used, and a partial abstraction of the carbon takes place, the glass is rendered green; when, however, other metals enter into the composition, *e.g.*, the oxide of copper, the deoxidation of the metal leads to the production of a bright crimson of an opaque character.

Having made some further remarks on modes of obtaining various coloured glasses, and alluded to the causes which prevent the English manufacturer from competing with the Bohemians, Mr. Pellatt proceeded to the second part of his subject.

Glass follows the usual law of contraction and expansion; and in passing from the state of ductility at which articles are manufactured to the solid state it contracts considerably, and gives off caloric so quickly that the outer portion becomes set and frangible, while the portion below the surface is passing more slowly into the same state. Opposing forces being thus brought into play, to prevent fracture, the articles, when manufactured, are annealed, by being placed in ovens of nearly the same temperature as the glass, and they are there allowed to cool gradually. During the process of annealing several changes take place—the glass is diminished in bulk, becomes less brittle, and is altered in colour.

In the process of annealing the purple colour of glass is invariably reduced, and if the process is continued too long the green tint succeeds. Glass of a green colour (oxide of iron being the colouring matter) is, under some circumstances, changed in the annealing-oven to yellow; this the author attributes to deoxidation of the glass, caused by exposure to the unconsumed carbon of the fuel in the annealing-oven. The loss of colour (or the change from purple to green) which takes place by annealing may again be recovered by gradually heating the glass to a red heat, in contact with atmospheric air; the green tint then disappears, and the pink returns.

Having noticed several instances in which a gradual change in the colour of the glass had taken place by exposure to the atmosphere—and this is particularly the case with the Bohemian plate glass, owing to manganese being used—the author concluded his paper as follows:—

"I have thus brought forward a few examples tending to prove that the changes in colour of glass are due to the presence or absence of a given proportion of oxygen. Manganese, as a metal, gives no colour to glass, although, by the oxygen which it yields to the lead in the mixture, a purple colour is produced. That the manganese has nothing to do with the production of the purple colour is evident from the fact that upon reducing the quantity of oxygen, either by polling or subjecting the glass to a long-continued heat, or by submitting it to the action of carbon, the purple colour is removed, though the manganese still remains. Iron and copper also assume different colours when combined with different proportions of oxygen. If this be true, may not all colours in glass (as well as the colours of the oxides of metals, such as iron, copper, and lead) be due to the combination of certain proportions of oxygen with the metal or metals present, so as to induce a particular molecular arrangement from which the glass has the power of absorbing a particular colour?"

A lengthened discussion followed the reading of the paper, in which Mr. A. Pellatt, Mr. Christie, Mr. Wilson, Mr. Palmer, and other gentlemen connected with the manufacture, took part; at the close of which the thanks of the meeting were voted to Mr. F. Pellatt for his communication.

ROYAL SOCIETY.

Thursday, March 29, 1849.

EXAMINATION OF THE PROXIMATE PRINCIPLES OF SOME OF THE LICHENS, BY MR. J. STENHOUSE.

Gyrophora pustulata.—The author states that this lichen, which is the "Tripe de Roche" of the Canadian hunters, has been long employed by the manufacturers of archil, though the quantity of colouring matter contained in it is by no means considerable, being little more than a twelfth of that in the Roccellei Montagnei. The Gyrophora pustulata, on which the author operated, was brought from Norway, where it is annually collected in considerable quantities for the manufacture of archil. The colouring principle was extracted by maceration with milk of lime, and was precipitated in a gelatinous state by neutralizing the lime solution by muriatic acid, precisely in the way so frequently described in the author's former paper ("Phil. Trans.," 1848). The precipitate was gently dried, and then dissolved in hot spirits of wine. On the cooling of the liquid, the colouring principle was deposited in small soft crystals, which, by digestion with animal charcoal, and repeated crystallizations, were rendered quite colourless. This principle, to which the author has given the name of "Gyrophoric acid," is almost insoluble in either hot or cold water, and is also much less soluble in hot spirits of wine than either orsellic, erythric, or any of the analogous colouring principles. It is neutral to test-paper, and possesses no saturating power, as the smallest quantity of an alkali gives its solutions an alkaline reaction. Gyrophoric acid strikes a bright red fugitive colour with hypochlorite of lime;

and when macerated with a solution of ammonia it is slowly converted into a purplish-red colouring matter, similar to that yielded by the analogous acids under the same circumstances. When subjected to analysis, the formula of gyrophoric acid was found to be $C_{36}\ H_{18}\ O_{15}$. Gyrophoric acid, when boiled for some hours in alcohol, yields an ether similar in appearance and properties to the erythric and lecanoric ethers. Its formula is $C_4\ H_5\ O_1 + C_{36}\ H_{18}\ O_{15}$. Gyrophoric acid unites with the alkalis and metallic oxides; but the compounds which it forms possess little stability, and cannot be procured of an uniform composition.

Lecanora Tartarea.—This lichen, like the Gyrophora pustulata, has been employed from an early period in the manufacture of archil. It is found in considerable abundance in the hilly districts of the northern parts both of Scotland and Ireland. The lichen on which the author operated came from Norway. He found it also to contain gyrophoric acid in much about the same quantity as the Gyrophora pustulata. This fact was established by the analysis of the acid itself, and of its ether compound.

Brom-orcine.—In the author's former paper on the proximate principles of the lichens he described a crystalline body obtained by cautiously adding bromine to an aqueons solution of orcine. In this second part he states that in the "Comptes Rendus" for August, of the same year, Messrs. Laurent and Gerhardt describe the very same compound, obtained in precisely the same way, without even hinting that it had been previously discovered. These gentlemen, however, give a different formula for the compound, viz., $C_{14}\ H_5\ Br_3\ O_4$; or, orcine in which three equivalents of hydrogen are replaced by three equivalents of bromine; and the author is disposed to adopt this formula, as, on repeating the analysis of the compound, he found that he had somewhat over-estimated the amount of bromine contained in it, while its other constituents were determined correctly enough.

Beta-orcine.—This substance may be obtained from usnic acid, either by destructively distilling it, or by acting on it with alkalis. Beta-orcine crystallizes very beautifully in four-sided prisms, surmounted at either end by four-sided pyramids. These crystals have a brilliant lustre, and are from three quarters of an inch to an inch long. Their solution strikes a fugitive bright red colour with hypochlorite of lime, and with a solution of ammonia it yields a permanent blood-red colouring matter, which becomes darker on standing. The formula of beta-orcine—which, however, is merely empirical — is $C_{16}\ H_{10}\ O_4$.

Quintonitrated-erythromannite.—In his former paper on the lichens the author has described, under the name of pseudo-orcine, a remarkably beautiful crystalline body, which is obtained by boiling either picro-erythrine, or erythric acid, with an excess of lime or baryta. This substance he then regarded as very analogous to mannite, both in its composition and properties; and, this view having been amply verified by an experiment which he has recently made, he has been induced to change the name of this compound to erythro-mannite, as at once indicating its origin and most striking properties. After referring to the discovery of Messrs. Flores, Domonte, and Menard, of "Mannite quintonitrique," or mannite in which five equivalents of water are replaced by five equivalents of nitric acid, and which possesses the remarkable property of detonating so violently when struck by a hammer that M. Sobrero has proposed employing it instead of fulminate of mercury, in the manufacture of percussion-caps, the author states that, when erythromannite is treated with fuming nitric acid in exactly the same way as mannite, it yields a perfectly analogous compound, or erythro-mannite, in which five equivalents of water are replaced by five equivalents of nitric acid. This compound, which he has called quintonitrated-erythromannite, is also insoluble in water, but crystallizes out of hot spirits in large flat crystals, resembling those of benzoic acid, only larger, and exhibiting a much more pearly lustre. Quintonitrated-erythromannite also detonates with great violence when it is mixed with a little dry sand, and is strongly struck with a hammer. In order to exhibit more distinctly the close analogy which subsists between the four compounds, their rational formulæ are given, viz.:—

Mannite.....	$= C_{12}\ H_{14}\ O_{12}$
Erythromannite	$= C_{11}\ H_{14}\ O_{11}$
Quintonitrated-mannite	$= C_{12}\ H_9\ O_7 + 5N\ O_5$
Quintonitrated-erythro-mannite.....	$= C_{11}\ H_9\ O_6 + 5N\ O_5$.

—*Lit. Gaz.*

MISCELLANEOUS CORRESPONDENCE.

DEFECTIVE EDUCATION OF THE CHEMIST AND DRUGGIST IN ENGLAND.

[To the Editor of the Chemical Times.]

Sir,—Much has been written at different times, and much more has been said, about the education of the chemist and druggist in this country; but, if we except what has been achieved by the exertions of the periodical chemical press, very little improvement can be said with truth to have been diffused among the members in general. That some few, we may say exceptional, examples have indeed obtained since the establishment of certain institutions having professedly for their object the advancement of the pharmaceutist, it were hard indeed, after the lapse of so long a period, to deny; but that the performance has been at all equivalent to the promises so profusely showered down, we also think it would be preposterous for any one to attempt to maintain.

A glance at the present degraded state of general and analytical chemistry among our chemists and druggists would throw some light on the actual state of British pharmacy, and would furnish an adequate notion of the state of the proficiency of a body whose competence demands at least an enlightened knowledge of chemistry—of that science, indeed, which forms the fundamental basis of their profession, and without which it cannot be said, properly considered, that pharmacy has any real existence. Yet it is very much to be regretted that more than two thirds of those who have the name of chemist and druggist are ignorant of the rudiments of their own calling, and have no practical acquaintance with analytical chemistry properly so called. A desultory and enforced method of what is commonly called testing may be, perhaps, more extensively diffused, but a scientific and systematic course of analysis, which alone is competent to obviate erroneous deductions, we anticipate is the almost universal desideratum. In consequence of such a state of matters it is naturally to be expected that the wholesale dealer interested in the sophistication of his goods imposes with impunity on the ignorance of his purchaser. But the retail chemist and druggist unintentionally is doing injustice to the prescription of the physician; and thus all in conjunction, chiefly through the ignorance of those whose province it ought to be to detect adulteration and expose the fraud, are at once imposing on the credulity of the patient, and this too frequently when the very existence of the latter is at stake.

When we consider that obtaining a chemical in a state of absolute purity is considered rather as the exception than the rule, it is surely time that more attention were given to the attainments of the chemist and druggist; but more especially that the chemical relations of his business were more stringently examined and inculcated. What the actual amount of adulteration, intentional or accidental, that is really carried on is we can, of course, only conjecture relatively from the numerous exposures which have from time to time been published in the *Chemical Times*; but of the extraordinary extent to which it is sometimes carried it is impossible that we can form an adequate notion. The only way to prevent the continuance of such imposition is, of course, to enlighten the chemist and druggist, by impressing more urgently than has hitherto been done the necessity of more extended acquaintance with chemistry and chemical analysis. When this shall be done we apprehend it will prove the most effectual means of banishing from the province of pharmacy both the ignorance of the chandler and the imposition of the manufacturer.

I am, sir, your obedient servant,
May 19, 1849. CHEMICUS.

APOTHECARIES'-HALL AND THE MEDICAL PROTECTION SOCIETY.

[To the Editor of the Chemical Times.]

Sir,—As the late, and the future, threatened persecutions are matters of serious consequence to many of your subscribers, I beg leave to offer the following remarks for publication, and the consideration of the parties interested. It must be gratifying to your numerous readers, and the highly-respectable body of chemists and druggists whose cause and interests you so warmly and so justly advocate, that you have, in the last number of your journal, exposed some of the secret doings of a private and secret inquisition, yclept "The Medical Protection Society." Your correspondent M.D. not having furnished you last week with the "Address" to the Medical Protection Society which was read to the members present at their meeting at the Freemasons' Tavern, Great Queen-street, on the 26th of March last, I herewith send you a verbatim copy of that address, as published in "The Medical Protection Circular" of the 2d of April. It is the following:—

"In anticipation of being called upon to make some remarks upon the subject of late proceedings, which the form of requisition addressed to the Medical Protection-office implies is the object of the present meeting, I beg to commit to paper my own impressions and opinions with regard to the future operations of the institution in reference to illegal practice. I think it particularly urgent on me to make these statements public, in order that my intentions may be thoroughly understood by a large portion of the profession, who have received an expensive professional education, yet not all the qualifications deemed necessary for the unlimited treatment of diseases. The remarks made by counsel in the recent case of Apothecaries' Society v. Lobo evinced the powers which might be exercised under that act, and certainly their stringency was made very manifest. But I believe there was no such opinion expressed as to the extent to which this institution would avail itself of those powers. The consequences of this uncertainty have been at once amusing and distressing.

"The Medical Protection-office has been the repository of various extraordinary revelations, the particulars of which must not be made public, but it bears on one hand of an influential body, who, having a fund, are determined to oppose its designs. It is visited by members of the College of Surgeons in the greatest consternation, and lastly;—but the following advertisement, copied from the *Times* of March 10, will explain more fully:—'Medical.—To be disposed of, for the sum of £400, a handsome and well-stocked shop, with a good practice attached, in a thickly-populated neighbourhood, the present returns £400 per annum, which in the hands of a qualified person would be greatly increased.'

"This makes the third which, to my own knowledge, has been advertised for sale, in consequence of the late conviction; and one has already changed hands under most distressing circumstances.

"The fact is, that chemists and druggists have so long been accustomed to prescribe, and even to visit, with impunity, it could scarcely be matter of surprise that young men who, having

attended all the necessary lectures, and undergone all the forms of a professional education, except that most important one, viz., a successful examination, should imagine themselves more qualified than the chemists and druggists, and, encouraged by the success which attended their unblushing assumption of professional practice, and the quiescence of Apothecaries'-hall, should assume with defiance a position which their examiners had decided them incapable of filling.

"I believe, however, now that such persons will pause before they commence a similar system, for they will soon find that those whose example they might feel inclined to follow will most assuredly be compelled to succumb before a course of action already determined upon, viz., a vigorous prosecution against every prescribing and visiting chemist and druggist, and I need scarcely say against every unqualified practitioner who assumes a position above the grade of a chemist and druggist.

"Of course the most active exertions will be necessary, and not alone on the part of the office; it will be requisite also that every member of it be engaged in the cause. It is to be hoped also that members holding only the diploma of the College of Surgeons will assist in this object for the honour of the body; for it is one of the grand features of this institution to combine all authorized grades of the profession, upon the reasonable supposition that, thus united, and divested of antagonism, they might together form a phalanx powerful enough to cope with that immense body of practitioners possessing no qualification at all, who, whilst the profession are striving after medical reform, have been undermining the ground round the whole fabric.

"To attack, then, the greater evil unitedly would be better policy than to weaken the strength of the fabric by points of difference, which, after all, are mere matters of opinion, whilst the evil complained of is a great fact known both in and out of the profession. In order, therefore, to effect a public good, I will show how the qualified practitioner will benefit by the system, and how he may safely, nay, very largely, subscribe for the purpose, with the absolute certainty of his subscription being returned to him tenfold. I wish to put the question in a new light, that is, in the position of pounds, shillings, and pence, and I have it in my power to do this in connection with the late case. The defendant has himself acknowledged that he was engaged to attend sixteen cases of midwifery, all of which he lost after the trial; some presenting one excuse, and some another, for dispensing with his attendance.

"I will not answer for the correctness of the defendant's statement, but I think it not improbable. Now, is it not a fair supposition that these sixteen cases were distributed amongst the medical men in the immediate neighbourhood?

"Taking for granted, then, the indisputable premises, that each man's subscription will return to him, either directly or indirectly, the amount of his contribution, with interest incalculable, the next question arises, in what manner is the fund to accumulate for carrying out the principles advocated by the Medical Protection-office, and shown to be practicable, in the late case instituted through its exertions?

"Had it not been for the opposition which the Medical Protection-office met with at the commencement of its career, which very materially checked its onward progress, though, at the worst, it has only delayed it to a future day, even by this short space of time it might have contributed to such a fund. But the receipts, in consequence of the large staff necessary to its working, have not yet repaid its founder the sums expended upon its establishment; therefore, for the present, this is not practicable.

"The calculation relative to the fund was made upon the expectation of obtaining four or five thousand members out of the thirty thousand medical men in the kingdom, whereas there are only about eight hundred; still, in nine months, this is even a wonderful success. I am happy to state, however, and I do it with the greatest certainty, that the result will eventually equal the expectations first anticipated; for it is a fact that, wherever agents are established, the office is supported. [Mark that!] For instance, Liverpool contains above forty members; Manchester the same; Sheffield twenty; and everywhere else there are equal prospects; whilst each week brings an increase of from sixteen to forty new members, that increase depending entirely and only upon the exertions and capabilities of the agents. [Mark this, all ye chemists and druggists in the United Kingdom; ye are beset with the agents of this inquisition.] There are three months yet to come for the completion of the first year, when it is anticipated that every actual expense, amounting to fifteen hundred pounds, will have been repaid, and this in the face of the most determined opposition. It is here necessary to state that the calculation with regard to the expense of prosecutions in illegal practice was made, not upon the expensive mode hitherto adopted by the Society of Apothecaries, but upon the experiment of summary conviction before a magistrate.

"To return, then, to the fund which it has become necessary to raise, by an appeal to the profession, this mode is thought more preferable than to increase the subscriptions—a plan recommended by many of our members.

"The fund will be placed in the hands of a treasurer, who, upon each case of illegal practice intended for prosecution, will be called upon for an advance of £10, a sum deemed sufficient for the necessary expenses over and above County Court fees. Upon the cause being gained, such costs as are allowed by the County Court, and paid by the defendant, will be returned to the treasurer.

"The above sum of £10 allows only for fees absolutely paid, including County Court fees, and counsel and solicitors' fees; but, as it is anticipated that the office will in some cases obtain half the penalty, it is calculated that the requisite staff [of spies and informers] for procuring evidence may be supported by this means; therefore I do not imagine that any further demands will be made upon the treasurer.

"In conclusion I beg to congratulate members of the profession upon the new and promising aspect of affairs, so likely to meet the greatest grievance to which it has been subject for many years; and I beg to express a hope that members will celebrate the first anniversary of the establishment of the office by a dinner at the Freemasons' Tavern upon the 1st of July.

"(Signed) "F. W. Breary."

I have thought it advisable that, through the medium of your columns, the great body of chemists and druggists should be put in possession of the secret workings of their enemies, and then it will be their own fault if they do not combine to defeat them. No single man goes out to fight an army. The letters of Mr. Pyke, the barrister, in your late numbers, have laid open to view some of the dark doings of the trading company, and have given some valuable legal hints for the future guidance of those lawyers who may be called upon hereafter to defend any action which may be commenced against a chemist and druggist or other person not holding the £20 certificate of Rhubarb-hall; but there are not many chemists and druggists sufficiently wealthy to retain "two clever counsel," and defray all the customary legal and illegal charges of a lawsuit. Therefore, would it not be advisable to call a public meeting of all the chemists and druggists in the United Kingdom, for the purpose of forming and carrying out a plan of operations which would entirely defeat the prosecutors, persecutors, spies, informers, and all that gang? There can be but one opinion on this point. All will say ay;—but what *is* the plan which may be considered reasonable and feasible?

The first step has been suggested by yourself in your last leading article, and was also strongly recommended by your correspondent M.D., to whom the threatened victims are indebted for his *exposé* of the secret iniquities of the upstart, illegal, persecuting society; therefore, the chemists and druggists, the Scotch, Irish, and foreign diplomas, should assemble and meet together,—should combine at once, under the title of "The Chemists and Druggists' Mutual Protecting Society." They should raise a fund by subscribing £1 1s. each, and as much more as the wealthier class can spare, and so secure ample funds to vigorously defend any action that may be hereafter brought against any one of them by the medical persecuting society, or its allies, or imitators.

Let every subscriber enter his name and address in a grand ledger to be kept for that purpose; and on payment of his subscription let him have a protection ticket signed by the secretaries and treasurers, and sealed with a proper seal, so that in the event of a subscriber coming under the persecution or prosecution of the apothecaries, or other persons illegally assuming rights and privileges, he may at once seek and find protection from "The Chemists and Druggists' Mutual Protecting Society." But that is not enough. This society should prepare a petition to be signed by its members, to be presented immediately to Parliament by an influential member of the House of Commons. That petition should set forth the fact that the chemists and druggists are a numerous and influential body, and, for the most part, better educated than the apothecaries generally. They, the petitioners, should explain their grievances, and expose the operations of "The Medical Protection Society" against them, under the title of "The Apothecaries' Company;" and they should also show, by extracts from the published proceedings of that society, their threatened intention of prosecutions and persecutions, &c. The petitioners should use every argument available to show the anomalous position in which the trading Society of Apothecaries stand in reference to the medical profession generally; and that it would be advisable to repeal at once the very objectionable act of 1815, 54th Geo. III., c. 194.

They should show that it would be tyrannical and unjust to interfere with the general established custom of chemists and druggists; that it would be unjust to interfere with their right and custom to make up physicians' prescriptions; and tyrannical and unjust to interfere with the right of the public to have their physicians' prescriptions made up where they please.

They should pray that the 54th George III., c. 194, be forthwith repealed.

And they should endeavour, without loss of time, to get an influential member of Parliament to bring in a short bill to repeal that obnoxious act.

There should be a circular sent to every chemist and druggist in the kingdom, directing his attention to the reported proceedings of the Apothecaries' Company and the Medical Protection (persecuting?) Society, as noticed in Nos. 140 and 142 of the *Chemical Times*, May 5th and 19th; and calling upon him to attend, either personally or by proxy, a public meeting to be held on the at the Freemasons' Tavern, the London Tavern, the Hall of Commerce, or one of the theatres, as most feasible, and to bring with him, or send by his proxy, his subscription of £1 1s. at the same time and place.

Books of subscription should be opened in every town in the kingdom, where subscribers might add to the fund to be raised for this righteous cause.

It is reasonable to expect that the wise and prudent will readily combine in order to defend each other from the threatened prosecutions and persecutions; and that they will see and understand that their subscriptions to such a fund would be, in effect, an insurance against annoyance, persecution, loss, and consequent ruin.

It has been shown that the members of the *soi-disant* Medical Protection Society (that is, the apothecaries) are all numbered, in order that their shameless proceedings may be carried on

against their unsuspecting neighbours in secret, like the proceedings of the Inquisition of old, and that under such an iniquitous state of affairs it is impossible to tell a friend from a foe; therefore, I suggest that it will be more prudent to combine, and resolve to retaliate upon that body indirectly, by avoiding all intercourse, professional or otherwise, with any member of the Apothecaries' Company, and being resolved to consult and employ professionally for ourselves and families, in future, only physicians, accoucheurs, and pure surgeons. Let every member of the future Chemists and Druggists' Mutual Protection Society act up to this suggestion until the Apothecaries' Act is repealed, and the iniquitous "Medical Protection Society" exterminated.

And now to business. Let a public meeting of chemists and druggists be at once convened, and the sinews of war collected, and success will follow.

I am, sir, your obedient servant,

ONE DEVOTED TO THE RIGHT CAUSE—
JUSTITIA.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

James Anderson, of Abbotsford-place, in the county of Glasgow, North Britain, starch-manufacturer, for a certain improved mode of separating the different qualities of potatoes, and other vegetables. Patent dated November 11th, 1848. Enrolled May 9th, 1849.

This invention has reference to a means of dividing or separating roots or vegetables, such as potatoes, into different classes, according to their economical value; or, in other words, according to the amount of solid nutriment contained in each. It is also equally applicable for other vegetables, such as carrots, turnips, &c.

According to actual experiment on the potato, the patentee finds that the specific gravity of a potato containing twenty per cent. of solid nutriment is about 1.080 (taking distilled water at the temperature of 56° Fahrenheit as unity); and that the potato of this quality will accordingly sink in water or any other fluid of less than that density, or indicating a density of less than 16° Twaddell; while a tuber containing nutritious properties to the extent of thirty per cent. is of a specific gravity of 1.120, or equivalent to a liquid indicating a density of 24° Twaddell, and will accordingly sink in a liquid of less specific gravity than 1.120. The patentee proposes to avail himself of the respective specific gravities of vegetables as a means of sorting potatoes and other vegetables into two, three, or several classes, according to the amount of nutritive matter respectively contained in them. For this purpose he places the vegetables in a pool, or vessel containing water or other fluid, brought to the density suited to the quality of the article. This is easily effected by adding to the immersion water salt, or a little clay, or other earthy matter in solution. The lighter tubers, &c., will float on the surface, and the heavier ones will sink to the bottom, and may accordingly be collected separately; these two qualities may then be further subjected to immersion in liquids of greater and less specific gravity, according to their qualities, and may by that means be still further divided into different sorts.

The patentee claims the system, method, or process of assorting tubers, or other vegetable matters, into different classes, according to their respective economical value, or, in other terms, to the amount of nutritive matter which they respectively contain.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MAY 15TH, 1849.

Charlotte Smith, wife of Jabez Smith, of Bedford, in the county of Bedford, for improvements in certain articles of wearing apparel. Patent dated May 14th, 1849; six months.

Samuel Allport, of Birmingham, gunmaker, for a certain improved method of making or manufacturing a certain part or parts of looms used in weaving. Patent dated May 14th, 1849; six months.

William Phillips Parker, of Lime-street, in the city of London, gentleman, for improvements in the construction of pianofortes. Patent dated May 15th, 1849; six months.—(Communication.)

John Thorn, of Ardwich, near Manchester, calico-printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns, and in dyeing fabrics and yarns when printed. Patent dated May 15th, 1849; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, engineer, and John Sharp Cromartie Heywood, of Islington, both in the county of Middlesex, for improvements in expressing and treating oils, and in the manufacture of varnishes, pigments, and paints. Patent dated May 15th, 1849; six months.

Moses Poole, in the city of London, gentleman, for improvements in apparatus for drawing fluids from the human or animal body. Patent dated May 15th, 1849; six months.—(Communication.)

Louis Alfred De Chatanvillard, of Rue St. Lazare, in the Republic of France, gentleman, for improvements in firearms, cartridges, bullets, bayonets, and ordnance. Patent dated May 15th, 1849; six months.—(Communication.)

PATENTS RECENTLY EXPIRED.

T. Dunkin, of Bordeaux, in France, late officer in the Hussars, for certain improvements in the mode, method, or system, of obtaining or producing duplicate copies of manuscripts, writings, and drawings; and in the apparatus or machinery used in the same. Patent dated May 13th, 1835; expired May 13th, 1849.

C. Chubb, of London, lock-manufacturer, for certain improvements in the means of making secure receptacles for property, such receptacles being either fixed or transportable, and being such as are usually called strong doors, safes, chests, and boxes. Patent dated May 13th, 1835; expired May 13th, 1849.

H. Dunnington and W. Copestake, of Stapleford, lace-manufacturers, for certain improvements in making or manufacturing lace. Patent dated May 13th, 1835; expired May 13th, 1849.

J. Buchanan, of Ramsbottom, millwright, for certain improvements in the construction of cylinder printing-machines used for printing paper, calico, and other fabrics. Patent dated May 13th, 1835; expired May 13th, 1849.

P. F. Ficher, Middlesex, merchant, for certain improvements in pianofortes. Patent dated May 13th, 1835; expired May 13th, 1849. (Communication.)

J. Ody, Strand, patent truss-manufacturer, for an improved construction of water-closets. Patent dated May 13th, 1835; expired May 13th, 1849.

C. Shafhautl, London, gentleman, for an improvement in the mode of manufacturing malleable iron. Patent dated May 13th, 1835; expired May 13th, 1849.

THE PALMA-CHRISTI OR CASTOR-OIL PLANT.—Coffee and cocoa being no longer exported from this colony save in very small quantities, there remains but sugar as an object of any profit to our trade with the mother country, but upon a vast scale, and with great capital; small sugar estates, as the proverb but too truly says, engendering great difficulties. Nevertheless Providence has surrounded the inhabitants of the tropics with a multitude of other useful plants—among others, the palma-christi. Wherefore, then, do they not turn to the culture of this precious shrub, which increases with so astonishing a rapidity in all soils, without being liable to the ravages of stock? It would prove a great help to the smaller proprietors if they would condescend to bestow some little attention upon its cultivation. A single tree of the palma-christi is estimated to yield about two quarts of grain per annum, weighing about 8 lbs. Consequently a carré (three and a half acres) of land, planted five feet apart, would produce about 12,000lbs. of grain, with almost no labour. The grain may be sold to great advantage, particularly at Marseilles. An inhabitant of the quarter of St. Ann has already planted in palma-christi several carrés of land upon one of his sugar estates, from which he expects to derive as much net profit as could be yielded by the cane. Barbados—known as the classic ground of colonial agriculture before and since the emancipation—has for many years been shipping to England considerable quantities of castor oil. But it would be far more advantageous to export the grain in its natural state, owing to the expense of working hands in the colonies, and the absence of proper machinery for its trituration and pressure. Besides, the residue, as a manure, would realize some value in France. The only trouble requisite, therefore, would be that of gathering the seeds, drying them in troughs, picking them, and then sending to market. It is known that castor oil (*l'huile de ricin*) is usefully employed in the manufacture of soap, and that France is tributary to foreigners for oleaginous seeds to the extent of upwards of thirty millions of francs; so that there needs be no fear of an outlet being wanting. The castor-oil plant (*Ricinus*) has been naturalized in the south of France, where it is annual, and therefore less profitably cultivated than in the colonies, and where, therefore, it is only retained as an ornament for the garden. The *Ricinus* has the advantage over the *Gigiri* of being secure not only against the ravages of herbiverous animals, but of rats, mice, and birds, which are so fond of the latter production.—*Martinique Paper.*

TO CORRESPONDENTS.

"Chemicus."—No. 139. Our correspondent professes to be a constant reader; we wonder how the lecture in question could have escaped his attention.

"Inquirer."—The subject on which our correspondent addresses us is not within our province.

"W. B."—A very good blue writing ink may be prepared as follows:—

Take of Sulphate of iron, 4 ounces.
Sulphuric acid, 2½ drachms.
Nitric acid, a sufficiency (about 1 ounce).
Ferrocyanide of potassium, 6 ounces.
Water, a sufficiency.

Dissolve the sulphate of iron in one pint of water, add the sulphuric acid, and heat the solution to boiling; pour in the nitric acid in small quantities at a time, continuing the boiling until the iron is peroxidized. Dissolve the ferrocyanide of potassium in two pints of water, and add the former solution, when cold, to this. Collect the precipitate that will be formed on a filter, and wash it carefully with distilled water until the blue precipitate begins to dissolve in the water. It will now be found to be soluble in pure water, although insoluble in water holding any other salt in solution. Rub the washed precipitate now, in a mortar, with distilled water, until a clear solution is obtained of the required intensity of colour. A little oxalic acid is sometimes added, but this is not necessary, since, if the above-given instructions be carefully followed, the precipitate will be perfectly and permanently soluble in pure water.

"R. T."—We beg to decline our correspondent's offer.

Mr. Richard Walker, Kennington, is referred to No. 128 of the *Chemical Times*.

"X. Y. Z."—We have answered the same question repeatedly. We refer our correspondent to our back numbers.

"A. B."—Resineone is an oily liquid obtained along with resinone during the distillation of resin with lime.

"Mr. Miller, Bristol."—Apply to the editor of the *Patent Journal*.

"Nemo."—The matter must stand over for five or six weeks.

ORIGINAL SERIES.

ON BENZOLE: ITS NATURE AND UTILITY.

A LECTURE.

By C. B. MANSFIELD, Esq.

[*Continued from page* 389.]

Benzole approaches, in its nature and properties, more nearly to ether than to any other of our usual solvents. In many cases it is an excellent substitute for that expensive material. However, being more oily than ether, it dissolves some substances which ether refuses, while there are other compounds generally, like ether itself, containing oxygen, which prefer the latter spirit to our hydrocarbon. Like ether, benzole takes up iodine readily, forming this beautiful red solution: with it thus, it forms no new compound, but with bromine and chlorine, the congeners of iodine, it behaves somewhat differently.

We thus pass to the third case of solution, that in which a chemical as well as a physical change takes place: of this capability benzole affords us an example. When brought in contact with chlorine under certain conditions, its nature is quite changed: it acquires altogether new properties. It behaves thus also under the influence of some other agents. One of the most remarkable instances is the effect which nitric acid has upon it. I had occasion just now to call your attention to a mode of action of sulphuric acid, in which it demeans itself not as an acid, but as swayed by a sort of lateral attachment. Nitric acid also, when in a peculiar state of concentration, is gifted with tendencies which disappear in its dilute state, and which impel it to act in a manner not regulated by its electro-negative polarity. It will then dissolve substances which, when engaged with water, it is unable to touch. Here is some of this acid diluted with water. I pour upon it some benzole: you see that the oil floats upon the acid as a colourless layer. Here is a flask containing some of the most concentrated nitric acid. I pour some benzole into it: it is immediately dissolved: the formation of a deep red colour when the liquids meet will show you that it is not a mere case of ordinary solution. Their acquaintance seems to be by no means a matter of indifference to them. Great heat is developed, which is increased by the addition of each drop of the oil; and you will observe the brown vapours which are thrown off from the mixture. I plunge the flask in cold water to moderate this ardour. When a certain quantity, however, of benzole has been introduced you will see that no farther action ensues, and some of the oil now floats on the top of the acid, which is satiated; by the addition, however, of some more acid I shall get it all dissolved. I have here considered the acid as the solvent, because it was more convenient to pour drop by drop the oil, than the other fuming liquid; but I might have represented the oil as the active party; in either case the solution is of the saturable sort. You will see presently that the oil, at least, has been quite changed in its nature by its intimacy with the acid; it would not be so easy to make you aware from its exterior appearance, by a rough experiment, that the acid has suffered to an equivalent extent; this, however, is the truth, but not the whole truth, for, besides that part of itself which it has bestowed upon the oil, it has undergone a farther decomposition, from the mere influence on the rest of it of the force of association; of this additional change you will accept as evidence the brown vapours, which were from time to time evolved during the mixing of the liquids. Every atom of those coloured fumes contained a portion of the vital nitrogen, which gave the name and character to the original substance, deprived, however, of a portion of the oxygen, to which it owed its power as an acid. That, of that part of the acid which was actually concerned in the combination, all the nitrogen has entered into the oil, and become with it one body, I cannot give you direct proof; but so it is, and I hope soon to give you some grounds for believing it.

I now pour my mixture into water. What remains of the acid at once obeys the law of its affinity, and the water eagerly receives it. But observe what occurs at the same time. The liquid is turbid, instead of transparent, like a mixture of common nitric acid with water; oily drops are falling rapidly through it. The cloudiness of the liquid is owing to the precipitation of this oil, which will presently collect itself into a layer at the bottom of the vessel. This behaviour will be sufficient proof to you that the character of the oil is entirely changed. It is no longer benzole. It has entirely lost the lightness and colourless brilliancy of our hydrocarbon. It has acquired a dull reddish-yellow complexion, and with it, too, another character which appeals very forcibly to one of our senses, an odour which you will at once recognise. I decant the acid water from the fallen oil, of which, to diffuse it in the air, I warm a drop in a spoon over the spirit-lamp. You will all perceive the luscious fragrance of oil of bitter almonds. This is a very striking metamorphosis; it is not, however, the poisonous product of which it reminds you; there is nothing radically evil in it; it may, indeed, be a very useful substance; here is some soap which has been perfumed with it; perhaps the ladies, who, unsuspectingly, have their scent-bottles charged with the ammonia from the coal-gas, may innocently condescend to admit to the service of their toilets this other contribution from the gas-works.

This oil is called nitrobenzole; the mode of its formation from our benzole is a process analogous to that, by which useful constructive fibre is deteriorated into the destructive gun-cotton. It is produced by the abstraction from the hydrocarbon, the hydride of phenyle (see Table II.), one atom of hydrogen (that one of its constituent atoms which most readily yields to the solicitation of elements for which it has a natural attachment; which may be called pre-eminently its replaceable hydrogen); and by the substitution for it of a compound atom, consisting of one atom of nitrogen and four of oxygen. When the benzole is placed in contact with the strong nitric acid, which consists of one equivalent of hydrogen, one of nitrogen, and six of oxygen, an interchange takes place, which will be understood at once by conceiving this equation to represent it:—

$$\underbrace{H;\ HO_6}_{\text{Nitric acid.}} + \underbrace{H,\ H_5\,C_{12}}_{\text{Benzole.}} = \underbrace{H;\ O + H;\ O}_{\text{2 water.}} + \underbrace{NO_4, H_5\,C_{12}}_{\text{Nitrobenzole.}}$$

The nitrogen of the acid, carrying with it four of its co-atoms of oxygen, cleaves to the phenyle, which it finds, we imagine, in the benzole; at the same time the weaker equivalent of hydrogen quits its position in the oil, and unites with one of the remaining oxygens of the acid, while the other similarly takes the hydrogen of the acid, thus forming two equivalents of water.

In Table II. are represented the compositions of several substances, some of which are producible by subjecting benzole to an analogous treatment with other reagents, and all of which, perhaps, owe their existence to this invisible phenyle, of which they are represented as material embodiments. They are all members of one "stirps," or line of development, in which the coherence of the compounds will be owing to the phenyle, while their individual characters will depend upon the accidental elements with which it is invested.

It is in this arrangement of $C_{12}\,H_5$ that the centre of consistence of our benzole was placed, we may suppose. We may conceive the hydrogen to have been grouped round the carbon, or, perhaps, the rest of the elements round six of the atoms of carbon (*vide* Table IV.). But now, by the introduction of this complex atom NO_4 instead of the simple atom of H, we have not only formed a substance containing a greater quantity of matter, but actually a more highly organized "body." This nitrogen which we have inserted becomes a new centre of vitality—the germ of new tendencies. We shall see that as it forms one of the group arranged about our central carbon, so some of the other atoms are dependent upon it as satellites, and will, so to speak, revolve about it. Our oil is no longer simply an indifferent oil, it is as yet neutral, but a new susceptibility has been engrafted on it.

I mentioned before that Dr. Hofmann had discovered that benzole existed in coal-naphtha by transforming it into aniline—a basic substance, which was recognisable by a peculiar reaction, by which I showed you the presence of the latter substance itself in the same crude oil. This formation of nitrobenzole is the first step of the process through which the hydrocarbon had to pass before it could be developed into aniline. The conversion of benzole into nitrobenzole had been observed by Mitscherlich soon after he first produced the hydrocarbon from benzoic acid; and Zinin showed that nitrobenzole was metamorphosed into an alkaloid by a peculiar mode of treatment. Mr. Leigh, of Manchester, had discovered that an oil of similar odour to oil of bitter almonds might be made from coal-naphtha, but it was not known at the period of his observations that this product contained, as amongst other substances it doubtless did, nitrobenzole.* It is now to the mode, by which our neutral nitro-oil is converted into a basic oil, and by which Dr. Hofmann detected benzole in its concealment in coal-tar, that I wish to direct your attention. Here are some benzole and some nitrobenzole. I shake each of them with some chloride of lime. Neither of them, you see, produces any colour with the solution. I now pour some nitrobenzole into a flask with some hydrochloric acid, and agitate them together; as yet nothing remarkable has occurred. I pour a few drops of the mixture into some chloride of lime solution: there is yet no blue colour. Now to my acid and oil I add a small quantity of zinc filings; you are well aware that the metal zinc decomposes hydrochloric acid, and liberates hydrogen. You observe the gas rapidly bubbling off: this is hydrogen. Now, an element just detached from composition is found to have a strong tendency to combine again. This hydrogen then, in the so-called nascent state at the first moment of separation, has powers which, when collected and kept, it can exert but feebly or not at all. In the present case it finds itself in contact, as it quits the chlorine, with the nitrobenzole, which contains four atoms of oxygen. On this oxygen, then, a part of the hydrogen seizes, dragging it from its seat, while another part satisfies its desire of attachment by taking the place of the oxygen in the oil. The change that has ensued is represented in this equation:—

$$\underbrace{6H + NO_4\,H_5\,C_{12}}_{\text{Nitrobenzole.}} = 4(H;O) + \underbrace{NH_2, H_5\,C_{12}}_{\text{Aniline.}}$$

The nitrogen has not stirred, the hydrogen and oxygen have turned as it were about it, and it here remains the centre of the characteristic properties of the substance. Our oil now is more than an oil: it has become an alkaloid too. It is now aniline. I pour some of my mixture into a beaker containing a dilute solution of the chloride of lime, and stir them together: you perceive the violet-blue colour, which we accept as a test of aniline.

Before taking leave of our benzole, I should inform you what it has become, in thus assuming the name and nature of aniline — what this aniline is which is connected so closely with our benzole, both as its compatriot in the tar, and as its descendent in this process of development. That our oil grows into a new nature, while it

* Since the above was written I have been informed by Mr. Leigh that he made, not only nitrobenzole, but pure benzole itself, from coal-naphtha; and that he stated this to the chemical section of the British Association at Manchester in 1842. By some oversight it seems this important fact escaped notice, for it is not mentioned in the reports of the association.

still retains some of its former characteristics, you will apprehend from this. Here is some aniline which has been prepared beforehand; here some benzole. I pour each into a separate glass containing some water; the aniline sinks to the bottom, the benzole floats at the top; here, then, is a superficial difference: but they are both oily to the water, neither will mix with it; here is an essential similarity. Now I pour into each water some hydrochloric acid, and stir the liquids; the aniline has disappeared, it is entirely dissolved; the benzole remains floating as before. Here is a radical distinction. I add to the hydrochloric solution some potassa: the aniline reappears, it is separated from its attachment by the stronger alkali, and remains as before oily, undissolved. Aniline, then, is endued with the basic attachment—it is an alkaloid. It may be taken as a type of the volatile organic alkaloids, a class of substances whose characteristic properties it possesses in a very marked degree. It is a compound ammonia.

Though the term ammonia is now universally known, as applied to a certain pungent gaseous alkaloid, the expression—an ammonia—may require to be explained. It frequently occurs in the progress of science that the revelation of a fact, or the appearance of an object, new in itself, but closely allied to some other fact or object, with which we were before acquainted, renders very convenient the provisional extension of an old specific term to the requirements of a group. The name, then, becomes generic till either a more fitting nomenclature is invented, or more comprehensive notions of its subject are attained. Chemistry is now in this position with regard to ammonia. This substance (NH_3) was once supposed to be the only volatile basic substance of complex constitution. However, we now know that there is a large number of such substances characterized like ammonia by containing nitrogen and hydrogen. Among these ammonia stands, the archetype marked by one negative quality, which is at once the distinction and the link between it and them. It contains no carbon. Here, then, I must ask you to accept this similarity of aniline to ammonia as evidence of what I just now stated, that the nitrogen of the nitric acid had entered into the substance of the oil, and had there become the centre of its new properties as an alkaloid, as before it was the animating principle of the acid.

This ammonia has been considered, for reasons which it would be out of place to detail here, as a compound of hydrogen, with a complex radical, amidogen, NH_2, as an amide of hydrogen. In the same way aniline, which is an exact analogue of ammonia in its attachments, may be viewed (as represented in Table II.) as an amide of phenyle. There are two grounds for believing this view to be a true one. The first is the formation of it in the mode which I have just described, in which this amidogen, NH_2, has been actually forced into our compound, as it were, from without. Aniline occurs also in other processes, in which its formation is more intelligible than are the steps of its derivation from coal; for instance, in the decomposition of indigo with potash; but this construction of it out of benzole, nitrogen, and hydrogen, throws especial light on its nature. And it is but one of a large number of its class which are formed in an exactly analogous manner: thus, on our coal-tar hydrocarbons, toluole and cumole, may alkaloids or aniloids, as they might be called, be erected by an exactly similar process; the constitution of these substances is shown in Table V. The other fact which confirms this view is the recent beautiful discovery of M. Wurtz, who has succeeded in constructing some compound ammonias by a process which demonstrates the nature of their connection with the typical alkaloid. It was well known that by treating cyanic acid, or the oxycyanate of hydrogen, as it might be called, with caustic potash, in a manner which need not here be described, ammonia was produced. Now, ethyle ($H_5\ C_4$) and methyle ($H_3\ C_2$) are two hyrocarbon compounds analogous to phenyle gifted with an imperfect basic attachment; they are, probably, electro-positive hydrogen, coupled by a lateral force with hydrocarbons (H, $H_4\ C_4$ and H, $H_2\ C_2$, just as sulphuric acid forms connections without losing its acidity), and still retaining its natural tendencies, modified by the adhesion of its parasites. These hydrogens, then, thus complicated in ethyle and methyle, still form attachments with electro-negative bodies. Of these the cyanates, or rather oxycyanates, of ethyle and methyle are instances. M. Wurtz found that, when either of these salts were decomposed with potash, instead of common ammonia, a new alkaloid was formed differing from ammonia (NH_3) by containing exactly as much additional hydrogen and carbon, as had been assumed by the electro-positive hydrogen in the salt decomposed. He obtained, in short, ammonias containing one atom of ethyle or methyle, instead of one of hydrogen, united with the compound NH_2, which was identical in all three cases. The formulæ of these substances are shown in Table V.: it will be seen that they are members of one series; and that aniline and its homologues, derived from toluole and cumole, are members of another series, both diverging from elementary ammonia, and ascending by successive increments of two atoms of carbon and two of hydrogen.

TABLE V.

Order of Ammonias $NH_2\ (H_m\ C_m')$

Instances of two series diverging from

Amide of hydrogen=NH_2,H=elementary ammonia.

Amide of methyle=NH_2,H, (H_2C_2)=methyline	——————?=NH_2,HC_8,(H_2C_2)=naphtidine?
" ethyle =NH_2,H,2(H_2C_2)=ethyline	Amide of phenyle=NH_2,$HC_8$2(H_2C_2)=aniline
	" toluyle =$NH_2\ HC_8$3(H_2C_2)=toluidine (Unknown.)
	Amide of cumyle=$NH_2\ HC_8$5(H_2C_2)=cumidine.

The inference is natural that the idea of an ammonia is a compound of the atom NH_2, with another atom, which may be either simple hydrogen, or hydrogen coupled with some one of a large class of hydrocarbons. As, in the formation of aniline from benzole, we forced as it were the amidogen into the system of the oil, so, in M. Wurtz's experiment, the hydrocarbon may be considered as having been driven into the alkaloid. These latter exquisite results must be viewed as the first steps in the elaboration of a series of alkalis of successively decreasing electro-positive attachment, which may prove to be as useful in metallurgic analysis as they are theoretically interesting.

It is probable, too, that the several increments of adopted hydrocarbon will make the resultant compounds more and more oily, as well as less and less alkaline. Simple ammonia is not the least oily, soluble to a very large amount in water in opposition to its expansive tendency as a gas; the methyle and ethyle ammonias are still soluble in water, not yet oily, though they are already liquids. Aniline, however, which contains so much more carbon, is a perfect oil, scarcely at all soluble in water. You will remember, too, the stirps of the alcohols and the fatty acids, which Mr. Brodie lately brought before you, the members of which rise above each other by successive additions of $H_2\ C_2$. Now, the earlier and simpler members of these series, for instance, alcohol and acetic acid, are soluble in water in all proportions, as perfectly aqueous in their habits as the earliest and simplest animals are, in every order of development, truly aquatic; but, as we mount higher in the series, we come to amphibious butters, soluble both in oils and in water, but in the latter only up to a certain limit of saturation; and finally, among the waxes we find that the increased complication of structure is attended with unmitigated oiliness; hydrophobia could not be more perfect in the elaborate organism of a cat or man than it is in beeswax.

That you may clearly understand what has become of our benzole in this aniline, I must state to you that aniline is not an alkali: it is not an analogue of potash or soda. These ammonias or aniloids are not alkalis. Typical ammonia is not electro-positive; it, and all the subordinates of its class, require to be united with one atom of hydrogen to make them electro-positive, to become analogues of potassium; and with one atom of a salt of hydrogen (an acid) to become a salt, of which latter state its union with an atom of water (in which the electro-positive attachment of the hydrogenous base has been satisfied by oxygen and) in which it becomes an alkali, is a particular instance.

Thus:—

Alkaloids.	Bases. (Not known separately)	Salts. Alkalis.	Salts. Chlorides
Ammonine=NH_3	Ammonium=NH_4	Ammonia=NH_4O	Of Ammonium=NH_4 Cl
Aniline=$NH_7\ C_{12}$	Anilium=$NH_8\ C_{12}$	Anilia=$NH_8\ C_{12}\ O$ (Unknown?)	Of Anilium=$NH_8\ C_{12}$Cl

This consideration of the nature and relationship of aniline will have explained to you the reason of the assumption of a specific term (phenyle) to express a partial system of atoms as existing among the constituents of benzole. It will be evident to you that these units of carbon and hydrogen are held together by a degree of force different from that which attaches to them the supplementary atom of hydrogen. I should, however, inform you that by treating nitrobenzole with a farther quantity of nitric acid, with the aid of time, of heat, or of sulphuric acid (which at least appropriates from the other acid its water of dilution, if by its actual presence it does not confer special powers), we may thus remove from our oil another atom of hydrogen, whose place in turn is occupied by tetroxide of nitrogen (NO_4): by this process we obtain this white crystalline solid dinitrobenzole ($NO_4 \left\{ \begin{matrix} H_4 \\ NO_4 \end{matrix} \right\} C_{12}$). But here the additional and greater power necessary to effect this farther change is but another testimony to the fact that the first atom of hydrogen was held in its place by a tie different from that which binds the others.

Aniline has thus contributed to illustrate the nature of benzole, though it may not have enlarged its sphere of practical utility. However, in connection with the question of economical service, I must point out to you how it may help to encourage a hope of achieving a result which to some seems very desirable, and would certainly be very practical, whatever we may think of its utility. It has been as great an object with many modern chemists to imitate certain of the organic alkaloids,—products of vegetation, which, as drugs, the practitioners of another so-called science have a habit of inducing patient humanity to swallow,—as it was with a few of the old alchemists to accomplish the manufacture of gold. Of these substances, which exert as remarkable an influence upon animal economies as the metal does in national ones, quinine ($NH_{12}\ C_{20}\ O_2$),

strychnine (N_2 H_{24} C_{44} O_8), and morphine (NH_{20} C_{34} O_6) are instances. Now, by subjecting aniline to a train of processes, Dr. Hofmann has succeeded in building up a series of alkaloids, in which several groups of elements, which have no basic tendency, are adopted by the central atom of aniline, and grouped around it so as to be taken with it into combination, in an electro-positive sense, by any acid to which the alkaloid may form an attachment. The names and constitutions of these superstructures on the foundation of benzole are these,—cyaniline (NH_2, H_5 C_{12}, $NC_2=N_2$ H_7 C_{14}), melaniline (NH_2, H_5 C_{12}, NC_2, NH_6 $C_{12}=N_3$ H_{13} C_{26}), dicyanomelaniline (NH_2, H_5 C_{12}, NC_2, NH_6 C_{12}, NC_2, NC_2, $=N_5$ H_{13} C_{30}). The sort of approach made by these elaborate accumulations of atoms to the results of vegetal synthesis above alluded to is obvious, and indicates a mode in which the desired construction of them may possibly be accomplished. However, it seems to me that there is another art, which is as far more desirable than that of manufacturing either gold or poisons, as it is more easy of attainment,—that of living without them.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LVIII.

(LECTURE LXXXVI.)

VEGETO-ALKALIS—(*Continued*).

QUININE AND CINCHONINE—(*Continued*).

SULPHATES OF QUININE AND CINCHONINE.

There are two sulphates of quinine—the neutral sulphate and the bisulphate.

The neutral sulphate of quinine crystallizes in small silky tufts, or in fine needles; it has an exceedingly bitter taste; when heated it becomes phosphorescent.

The dry salt is composed of—

1 equiv. of quinine,
" sulphuric acid,
" water.

In the crystalline state it contains, besides these elements, 7 equivs. (=14.4 per cent.) of water. It effloresces in dry and hot air, and loses a more or less considerable proportion of its crystallization water.

It is sparingly soluble in cold water; it dissolves in 30 parts of boiling water. It is much more soluble in alcohol, particularly in hot alcohol.

The acid sulphate or bisulphate of quinine is much more readily soluble than the neutral sulphate.

Cinchonine forms with sulphuric acid two salts corresponding to the neutral and bisulphate of quinine.

The neutral sulphate of cinchonine is composed of—

1 equiv. of cinchonine,
" sulphuric acid,
" water.

In the crystalline state it contains, besides these elements, 2 equivs. of crystallization water.

The neutral sulphate of cinchonine crystallizes in very short six-sided prisms, derived from an oblique rhomboïdal prism. It has a bitter taste. When heated it becomes phosphorescent. When heated beyond 212° Fahrenheit it melts like wax. At 248° Fahrenheit it loses the whole of its crystallization water.

The sulphate of cinchonine is more readily soluble than that of quinine. 54 parts of water at the common temperature suffice for its solution. At 55.4 Fahrenheit it is disslved by 6.5 parts of alcohol of 85 C., and by 11 parts of anhydrous alcohol.

The bisulphate of cinchonine is exceedingly soluble.

PREPARATION OF SULPHATE OF QUININE.

The sulphate of quinine is prepared mostly from the yellow or Calisaya bark.

The bark is to be submitted, in the first place, to a preliminary examination, for the purpose of ascertaining the amount of vegeto-alkali contained in it. The surest and safest way is to take a certain quantity, say about two pounds, of the bark, and to treat this by the common process for the preparation of sulphate of quinine. A prompter, but less conclusive, test is the precipitation of a decoction of the bark by means of infusion of gallnuts; the amount of vegeto-alkali contained in the bark being estimated from the less or greater abundance of the precipitate formed. Gelatine strikes a white or greyish, tartar emetic a yellowish, precipitate in decoctions of bark. Solution of persulphate of iron colours decoction of bark green; sometimes it produces an abundant greyish-black precipitate; after the subsidence of this precipitate the supernatant liquid looks green.

All these reactions are owing to the tannin which the bark contains, and are, accordingly, no criterion of the amount of vegeto-alkali present, although many sorts of bark contain tannin and the vegeto-alkalis in corresponding proportion. The reaction with infusion of gallnuts is a much more reliable test for distinguishing good from inert varieties of bark, since the precipitate which forms upon the addition of this infusion to decoctions of bark is produced solely by the combination of the gallic acid with the quina or cinchonia.

M. Guillermond, the younger, has given the following very commodious process for testing bark:—Reduce the bark to powder, and treat this, by the method of displacement, with ten parts of alcohol of 80 Cent. (31° Cartier). Add to the alcoholic product 30 grammes of pulverized quicklime for every kilogramme of bark, and agitate the mixture repeatedly; by this operation the liquor is almost completely decolorated. Remove the calcareous precipitate by filtration, and add to the filtered liquid sulphuric acid in quantity sufficient only to impart to it the very faintest acid reaction. Distil it; filter off the trifling quantity of resin which has precipitated, and concentrate the filtrate to crystallization. A minute quantity of sulphate of quinine remains in the mother liquor, from which it may be obtained by the appropriate process. This last operation may, however, in most instances be omitted, as the quantity of sulphate in the mother liquor is usually very minute only.

The following is the usual process of preparing sulphate of quinine:—

Pound the bark coarsely, and let it macerate in water, to which you will have added previously 60 grammes of hydrochloric acid for every kilogramme of bark. Next morning boil the mixture, and keep it boiling for two hours;* strain. Subject the bark to a second and third decoction in water containing 30 grammes of hydrochloric acid for every kilogramme of bark. Make, finally, a fourth decoction in pure water, and keep the product of this for the preparation of the first acid decoction of a fresh quantity of bark. After this fourth decoction the bark may be thrown away; the liquors hold in solution the whole of the quinine and cinchonine originally contained in it.

Add now to the hot liquors carbonate of soda slightly in excess, and let the precipitate which forms subside. Decant off the supernatant liquid, and test it by means of ammonia; should this reagent produce a precipitate, the liquid must be precipitated once more with carbonate of soda. The whole of the calcareous deposit is placed on a linen filter, and left to drain; it is subsequently subjected to the action of the press, and finally dried in the stove.

[The acid decoctions of the bark contain the quinine, the cinchonine, the yellow colouring matter, the red principle, kinic acid, and hydrochloric acid. The soda saturates these acids, and forms with them soluble salts (kinates and hydrochlorates), which remain in the liquid together with a portion of the colouring matter. The precipitate produced by the carbonate of soda in the acid decoction of the bark consists of quinine and cinchonine, a compound of the alkali with the red principle, fatty matter, and some colouring matters formed partly by the action of the hydrochloric acid upon the divers colouring principles of the bark.]

As soon as the precipitate is perfectly dry reduce it to powder, and treat this five, six, seven, or eight successive times with alcohol of 86 Cent., at the heat of the water-bath; squeeze the grounds each time, and filter the alcoholic liquors. The alcoholic fluid contains the quinine and cinchonine, some fatty matters, and colouring substances.

Acidulate the alcoholic fluid with weak sulphuric acid to an extent sufficient only to impart the faintest acid reaction to it. Distil, and let the distillation apparatus cool. You will now find a crystalline mass, which you must let drain on a linen cloth, to get rid of the black mother liquor which soils it. After draining, wash the crystalline mass with a little water, to remove the greater portion of the mother liquor still adhering to it.

Make the crystalline mass (which appears still rather strongly coloured) into a paste with warm water; mix with this animal charcoal in powder, and leave the paste till next morning, to give time to the charcoal to act.

Mix the paste with an appropriate quantity of water, and boil, taking care to carry the concentration sufficiently far to obtain crystals upon the mere refrigeration of the liquid. (It is advisable to divide the paste for this purpose in several portions, and to treat them separately.) Filter the liquid boiling. Upon refrigeration of the liquid the sulphate of quinine will crystallize in perfectly white crystals. At the end of forty-eight hours let the mother liquor drain off, place the crystalline mass on some double folds of paper properly arranged for the purpose on a hurdle, and carry it to the stove, taking care to keep the salt covered, since otherwise it would acquire a yellow colour. It is equally necessary to remove the salt from the stove as soon as it is dry; were it left beyond the time absolutely required for its drying, it would commence to effloresce, and, accordingly, lose in weight.

Precipitate the mother liquor which had deposited the white sulphate of quinine with ammonia, which removes the whole of the quinine and cinchonine still contained in it. Dissolve the precipitate (with the aid of heat) in water acidulated with sulphuric acid, and add, towards the end of the operation, animal charcoal, and, if necessary, a little chalk to saturate the excess of acid. Boil the liquid to a proper degree of concentration, and filter boiling. The filtrate will deposit a fresh amount of white crystals.

Treat the mother liquor of this second operation in the same way as you have that of the first, and continue to proceed in this manner until the whole of the vegeto-alkali is converted into crystallized sulphate. In this series of operations take care to avoid the evaporation of the mother liquors, since, during that process, colouring matter would be produced, which you would find it exceedingly difficult afterwards to get rid of.

After the third precipitation it is sometimes found advantageous to treat the precipitate with alcohol of 64 Cent., instead of dissolving it in water acidulated with sulphuric acid; the alcohol dissolves the quinine alone. In this case the cinchonine is made to crystallize separately; but, as the form of sulphate of cinchonine differs from that of the sulphate of quinine, it is advisable to push the crystals back into the liquid, by

* I have obtained a larger amount of product by continuing the several processes of decoction only for half an hour each, instead of for two hours.

scraping the sides of the vessel with a spatula, whereupon the sulphate of cinchonine is deposited at the bottom in the pulverulent form, in which it may then be readily mixed with the sulphate of quinine.

The black (alcoholic) mother liquor from which the coloured sulphate had crystallized in the first instance retains still portions of quinine and cinchonine, which need not be lost.

Part of the vegeto-alkali still remaining in the mother liquor is deposited spontaneously in the course of time, as sulphate; the crystals thus deposited may be readily purified by the ordinary method.

The extraction of the vegeto-alkali still retained in solution by the mother liquor is a task of very considerable difficulty. The following process (Guibourt's) succeeds best:—

Add to the black mother liquor an equal weight of a solution of sea salt, marking 15°.

Boil the mixture for ten minutes, decant, and subject the brown deposit which has formed twice more to the same operation.

Pour the decanted liquors together; let them get cold, and filter; precipitate the filtrate with ammonia.

Redissolve the brown deposit which had separated from the saline liquid in the third operation in water, and add gradually, and in small portions at a time, ammoniated salt-water, taking care to stop short of complete saturation. Filter the liquid off the soft brown precipitate which forms, throw the latter away, and precipitate the filtrate with ammonia. Treat the several ammoniacal precipitates with alcohol, in order to separate the insoluble earthy phosphates. The alcoholic solution, treated in the proper way, will yield sulphate of quinine and sulphate of cinchonine.

The quantities of sulphate of quinine or sulphate of cinchonine respectively furnished by the several varieties of bark which occur in commerce, are as follows:—

One kilogramme of Calisaya bark yields (without the rind) 32 to 34 grammes of sulphate of quinine.

One kilogramme of Calisaya bark yields (with the rind) 24 grammes of sulphate of quinine.

One kilogramme of grey Loxa bark yields 12 to 16 grammes of sulphate of cinchonine.

One kilogramme of grey Lima bark yields 12 grammes of sulphate of cinchonine.

One kilogramme of intensely red bark yields 16 grammes of sulphate of quinine, 8 grammes of sulphate of cinchonine.

One kilogramme of pale red bark yields 12 grammes of sulphate of quinine, 8 grammes of sulphate of cinchonine.

One kilogramme of spongy Carthagena bark yields 3 to 4 grammes of sulphate of cinchonine.

SULPHATE OF QUININE WINE.

Take of Sulphate of quinine, 66 centigrammes.
Madeira wine, 1,000 grammes.

Dissolve.—(Magendie.)

The sulphate of cinchonine wine is prepared in the same way, but with double the dose of the salt.

SYRUP OF SULPHATE OF QUININE.

Take of White sugar syrup, 300 grammes.
Sulphate of quinine, 1 gramme.
Distilled water, 4 grammes.
Sulphuric alcohol, 4 drops.

Dissolve the sulphate in the smallest possible quantity of water with the aid of the sulphuric alcohol, and mix the solution with the syrup.

30 grammes of the syrup contain 10 centigrammes of sulphate of quinine.

The syrup of sulphate of cinchonine is prepared in the same way, but with treble the dose of the salt.

LOZENGES OF SULPHATE OF QUININE.

Take of Sulphate of quinine, 1 gramme.
Sugar in powder, 300 grammes.
Mucilage of gum arabic, a sufficiency.

Make into lozenges of 1 gramme each.

Each lozenge contains 3 milligrammes of sulphate of quinine.

POMATUM AGAINST ALOPECY.

Take of Beef marrow, 12 grammes.
Sweet almond oil, 4 grammes.
Sulphate of quinine, 1 gramme.
Essence of roses, 2 drops.

Incorporate the sulphate of quinine thoroughly in the liquefied mixture of the fatty bodies. Aromatize with the essence of roses.

A small quantity of this pomatum is to be applied every morning on the head.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

EXPERIMENTS ON THE NITROGENOUS COMPOUNDS OF THE BENZOIC SERIES, FOLLOWED BY REMARKS ON CARBANILIC ACID AND THE CARBANILATES.

By G. CHANCEL.

These experiments relate principally to the action of the hydrosulphate of ammonia upon nitrobenzamide. This substance was first obtained by Mr. Field by the action of heat upon the nitrobenzoate of ammonia; but this process does not always succeed, and I have found it most advantageous to prepare it from nitrobenzoic ether and ammonia.

The action of the hydrosulphate of ammonia upon nitrobenzamide dissolved in alcohol is frequently very complex, whilst with an aqueous solution it is very simple; in the latter case there is a considerable deposit of sulphur and of crystals, which, according to my analyses, contain $C^7 H^8 N^2 O$ + aq. The water of crystallization is expelled between 212° and 248°.

The formation of this body is in conformity with the known reactions of the hydrosulphate of ammonia upon nitrogenized substances; we have, in fact, $C^7 H^6 XNO + 3SH^2 = C^7 H^8 N^2 O + 2OH^2 + 3S$;* but, if the formation of this substance comes within the known reactions, the change of functions which has taken place is hitherto without example in organic chemistry; for it no longer belongs to the benzoic series, but represents carbanilamide or anilamic urea, that is to say, a double carbonate of aniline and ammonia less 2 equivs. water ($CH^2 O^3$, $C^6 H^7 N$, NH^3) — $2OH^2 = C^7 H^8 N^2 O$. This opinion is founded upon the following facts:—When carbanilamide is heated with potash lime, ammonia is disengaged at a slightly elevated temperature, which I determined in the state of the platinochloride. When heated still more strongly no more ammonia is given off, but only pure aniline. The following equation will explain this metamorphosis:—

$C^7 H^8 NO + 2OKH = CO^3 K^2 + C^6 H^7 N + NH^3$.

But this equation evidently does not represent the final reaction, and we must distinguish two phases, in

The first, $C^7 H^8 NO + OKH = NH^3 + C^7 H^6 KNO^2$.

The second, $C^7 H^6 KNO^2 + OKH = C^6 H^7 NCO^3 K^2$.

The salt of potash which is produced in the first phase must be the anthranilate or an isomeric compound, in all cases the true carbanilate.

This experiment proves that carbanilamide contains the constituents of 1 equiv. ammonia and of 1 equiv. aniline. The action of sulphuric acid is equally distinct, and supports my opinion; it furnishes, in fact, sulphanilic acid and sulphate of ammonia with disengagement of carbonic gas:—

$C^7 H^8 NO + 2SO^4 H^2 = CO^2 + C^6 H^7 NSO^3 + SO^4 H^2, NH^3$.

By acting with cyanic acid upon aniline M. Hofmann obtained a substance to which he likewise assigns the composition of anilamic urea. As this chemist has merely announced the production of this substance, without describing its properties, I am not able to assert their identity.

Carbanilamide possesses the following properties:—It is soluble in water, alcohol, and ether; its alcoholic or ethereal solution quickly acquires a dark red colour, and appears to experience some change, but its aqueous solution is not altered, and furnishes on spontaneous evaporation very beautiful, transparent, flattened prisms of considerable size. The crystals have no odour; they have a cool, very slightly bitter taste, similar to nitre; they contain 1 equiv. water of crystallization, melt at 161°, and are decomposed at a higher temperature, leaving a large amount of carbon.

Carbanilamide, like urea, combines with acids and metallic salts, furnishing crystalline compounds. I have analyzed the following:—

The nitrate ..... $C^7 H^8 N^2 O, NO^3 H$
The argentonitrate .. $C^7 H^8 N^2 O, NO^3 Ag$
The chloride ..... $C^7 H^8 N^2 O, ClH$

I likewise obtained the hydrargyrochloride and the platinochloride.

In concluding this extract I may state that I have also analyzed the ethers of nitrobenzoic acid; that from alcohol crystallizes in right rhombic prisms of 122°; my analyses confirm those of M. Kopp; that from pyroligneous ether crystallizes in nearly the same form (118° to 120°); the two ethers are consequently isomorphous.

ON CARBANILIC ACID AND THE CARBANILATES.

In the preceding part I have shown that, under the influence of the hydrosulphate of ammonia, nitrobenzamide is converted into a new substance, anilamic urea, to which I assigned the name of carbanilamide. I stated that when carbanilamide is heated there is disengaged at first ammonia, and subsequently at a higher temperature pure aniline. As I suspected, the two following phases must be distinguished in this metamorphosis by potass:—

First phase,

$C^7 H^8 N^2 O + O(KH) = H^3 N + C^7 H^6 KNO^2$.

Carbanilamide. Carbanilate of potass.

Second phase,

$C^7 H^6 KNO^2 + O(KH) = C^6 H^7 N + CO^3 K^2$.

The carbanilamide is, in fact, converted with the greatest ease into carbanilate of potass. It is merely requisite to boil this substance with a concentrated solution of caustic potash until no more ammonia is evolved, and then to add an excess of acetic acid. If the liquid is not very concentrated no precipitate results; and the carbanilic acid is deposited on cooling in orange-coloured crystals, which are purified by recrystallization.

This acid exhibits some very characteristic reactions, and furnishes crystalline salts. Its composition and its metamorphoses prove clearly that it must be viewed as the bicarbonate of aniline minus the elements of 1 equiv. water,—

$(CH^2 O^3, C^6 H^7 N) - H^2 O = C^7 H^7 NO^2$;

for the alkaline and earthy carbanilates, when heated with potass or caustic baryta, are converted into carbonates and aniline. When carbanilic acid is heated suddenly with spongy platinum, it is resolved into carbonic acid gas and aniline; sulphuric acid converts it into sulphanilic acid.

The composition of carbanilic acid has been determined by the analysis of the acid and of the salt of silver; it is expressed by the formula, $C^7 H^7 NO^2$. The carbanilate of silver is nearly insoluble in cold water, tolerably soluble in hot, from which it is obtained in beautiful crystals by cooling. It is not altered at 212°, and may be perfectly dried; but at a highter temperature it is decomposed. Its composition accurately corresponds with the formula, $C^7 H^6 AgNO^2$.

It is seen, therefore, that carbanilic acid is a monobasic acid; that is to say, capable of exchanging 1 equiv. of hydrogen for 1 equiv. of metal. Its metamorphoses, moreover, prove that it is a conjugate acid, formed by the union of 1

* X=NO^2 C=12 H=1 O=16 N=14, notation of M. Gerhardt.

equiv. aniline and 1 equiv. carbonic acid, with the elimination of 1 equiv. water.

I should observe, in concluding, that carbanilic acid obtained by the action of potash upon carbanilamide appears to be identical with the benzamic acid of M. Zinin, and even with the anthranilic acid of M. Fritzsche; however, I merely mention this opinion with a certain reserve, comparative experiments being still wanting; but, at all events, if these acids are not absolutely identical, they are very nearly allied. It is evident that they are more than isomerous, for they all possess the same fundamental properties, and are metamorphosed in the same manner under the influence of reagents. It will, therefore, be necessary to regard them as varieties of one and the same chemical species, of which we have more than one example in chemistry. I need merely mention tartaric, metatartaric, and paratartaric acids which are isomerous, have the same capacity of saturation, and are decomposed in the same manner under the influence of powerful reagents. I intend shortly to publish some comparative observations on anthranilic, benzamic, and carbanilic acids.—*Comptes Rendus.*

ANALYSIS OF FAUJASITE.

By M. A. DAMOUR.

The author states that in a notice inserted in the first volume of the fourth series of the "Annales des Mines" he gave a description of a mineral belonging to the zeolite family, which, on account of its crystalline form and composition, appeared to him to constitute a distinct species; to this mineral he gave the name of Faujasite. The rarity of the mineral at the time it was discovered prevented M. Damour from employing more than a very small quantity for analysis. Having, however, lately procured several specimens, they were employed in repeating the analysis.

The fresh analysis gave as the composition of this mineral:—

Silica	46.12
Alumina	16.81
Lime	4.79
Soda	5.09
Water	27.02
	99.83

In his first notice the author stated that faujasite retained its transparency after heating to redness, and was acted upon by acids; he has since found that the mineral loses these properties when heated to near its melting point; it then disengages the last traces of water, becomes milk-white, and hydrochloric acid, cold or boiling, does not act upon it.—*Ann. des Mines*, tom. xiv., p. 67.

ON EDIBLE BIRDS' NESTS.

By ED. BLYTH, Esq.,
Curator of the Asiatic Society's Museum.

[*Concluded from page* 394.]

The people who gather the edible nests practise a variety of superstitious ceremonies in relation to them, which belong rather to their history than to that of the birds, and therefore need not be here described. But another point of interest arises respecting the actual species which produce them; and it would seem that all the authorities to whom I have access, who have discriminated different species of these birds, are more or less in error. Firstly, as regards the Hirundo esculenta of Linnæus (founded on Brisson's description of one of M. Poivre's inaccurate drawings), there is no reason to suppose that this as described, with yellow irides and white-tipped tail, has any prototype in nature; the latter would be an anomaly throughout the Cypseladiæ, but may refer perhaps to the white tail-markings of some real Hirundo, erroneously supposed to be the constructor of the edible nests.* Dr. Horsfield gives the species termed Lawet by the Javanese as Hirundo esculenta, Osbeck, stating that the specimens which he examined in Java, and those which he took to England, differ from Latham's description in being uniformly of a blackish colour, without a white extremity to the rectrices. Another species, the Linchi of the Javanese, he gives as H. fuciphaga, Thunberg, stating that "Its nest is constructed of mosses and lichens, connected with the same gelatinous substance which composes the edible nest of the preceding species."† This accords with what has been already cited from Raffles; and in an interesting account of Karang Bolong, on the southern coast of Java, and of the birds'-nest rocks there, translated from the "Tijdschrift voor Neerlands India" in the "Journal of the Indian Archipelago," i., 107 (Sept., 1847), the same two species are distinguished by the names Lawet and Lintye, and the nest of the latter is described to be "without the least value. The residence of these swallows" (swiftlets), "termed Lintye in the eaves," it is added, "contributes greatly to the injury of the holes, for which reason they are destroyed as much as possible at each gathering. The nests which they make are constructed of grass stalks. They are, however, of the same form, and are as artfully made as the others."

Heer Hooyman likewise states that besides the Lawet (Waled or Boerong‡ Daija of the hill Javanese), "other species resort to the same caverns, which are named Momomo, Boerong itam,§ Boerong zoekoet, and Lintje. These," he adds, "are very similar to each other, excepting the second, which has the head larger, and the feathers of all are entirely black. The nests which they construct are black and friable, composed of a light down" (agglutinated?). "An opinion prevails that the presence of these birds is injurious to the caverns, on which account they are driven away as much as possible." Another writer in the same volume of the "Bataviaasch Genootschap" (p. 248) mentions the Momos or Boerong itam (thus bringing together M. Hooyman's first two species) as a larger kind, with plumed tarsi, indicating thus a true Cypselus, which is probably the constructor of the nests assigned by Dr. Horsfield and others to the Linchi. Assuredly, however, the C. fuciphaga (Thunberg), Linchi or Lintye of the Javanese, identical upon comparison with Javanese specimens, would appear to be the sole producer of the numerous nests gathered on the rocky coasts of the Bay of Bengal; and the often quoted notice by Sir G. Staunton, in his account of the Earl of Macartney's embassy to China, must refer either to C. fuciphaga, or to an entirely new species (which is hardly to be supposed in the locality). For he remarks that "The birds which build these nests are small grey swallows, with bellies of a dirty white. They were flying about in considerable numbers; but they were so small, and their flight so quick, that they escaped the shot fired at them."‖ This was at an islet off the southern extremity of Sumatra, close to where M. Poivre also observed them, who remarks that "leur taille étoit à peu-pres celles des Colibris."¶ The birds may have appeared greyish on the wing, but the white belly is characteristic of C. fuciphaga; and this particular species occurs abundantly on parts of the coast of the Malayan Peninsula, in the Nicobar Islands and Mergui Archipelago, and so high as on certain rocky islets off the southern portion of the coast of Arracan, where the nests are annually gathered and exported to China. From all this range of coasts we have seen no other species than Fuciphaga, nor does it appear that any other has been observed; and we have examined a multitude both of the adults and of young taken from the nests collected in the Nicobars and preserved in spirit, all of which were of the same species. Nevertheless, what appears to be C. nidifica inhabits the mountains far in the interior of India, though hitherto unobserved upon the coasts; and it is worthy of notice that C. fuciphaga does not appear to have been hitherto remarked inland in this country. The species which builds the edible nests collected on the western coast of the Indian peninsula, as in the group of small islands about eight miles west of Vingorla (which is a little above Goa, and 275 miles from Bombay), commonly known as the Vingorla Rocks, where about one cwt. of them are produced annually, remains to be ascertained.

C. NIDIFICA; Hirundo nidifica, Latham; H. fuciphaga apud Shaw; H. esculenta apud Horsfield; H. brevirostris, M'Clelland, P. Z. S., 1839, p. 155; H. unicolor, Jerdon, "Madr. Journ.," xi., 238; referred by that naturalist to Cypselus, ibid, xiii., 173, and termed C. concolor, J. A. S., xi., 886 (there being a previously described C. unicolor). Length $4\frac{1}{2}$ to $4\frac{3}{4}$ inches, the middle tail feathers 2 inches, and outermost $\frac{3}{8}$ inch longer; wing $4\frac{1}{2}$ inches. General colour fuscous-brown, darker on the crown, wings, and tail, which latter have a dull gloss of steel blue or green, below paler. From M. Hooyman's description of this species we feel satisfied of the identity of the Indian and Javanese birds, which some of the translated accounts had rendered doubtful.

This species, in India first observed in Assam, appears to be a regular bird of passage at Darjeeling, where Capt. Tickell observed flights of them commencing in August, proceeding to the S.W. Mr. Jerdon remarked it "on the Coonoor Pass of the Nilgiris, and about the edges of the hills. It flies in large flocks and with very great speed." Its nests remain to be discovered in this country.

C. FUCIPHAGA; Hirundo fuciphaga, Thunberg. A minute species, about $3\frac{1}{2}$ inches in length by 9 inches in expanse, the tail $1\frac{1}{2}$ inch and even, wing $3\frac{3}{4}$ inches. Colour above blackish, green and purple glossed; below, fuscous-brown, passing to white on the middle of the belly, with whitish edges to the lower tail-coverts. A single large feather, with a distinct supplementary plumelet, grows on the hind toe, being nearly as long as the toe with its claw; this is always normally present, but is often lost in dry specimens.

This bird is the edible nest-builder of the Bay of Bengal, and may prove to be exclusively a coast species, the nests of which are of superior quality to those of C. nidifica? In the extreme east it is, perhaps, replaced by C. troglodytes of Mr. G. R. Gray. The Rev. J. Barbe, from personal observation, notices it as "common in the archipelago of Mergui, the Nicobars, &c., building their nests in the cavities of the rocks, where it is most difficult and perilous to have access. Formerly," he adds, "both Malays and Burmese procured at the Andamans a considerable quantity of these nests, collecting them themselves, or receiving them from the islanders in exchange for their tobacco, &c."* But it appears that both people, "taking advantage of the time in which the natives were on board their vessels, tied them up, and carried them off as slaves." Hence the present hostility of the rude Papuan inhabitants of the Andaman Islands to all foreigners whatsoever.

ADDENDUM.—Edible Nests in Ceylon.—A most obliging correspondent in Ceylon, Dr. E. L. Layard, informs us that he has learned of a

* I find, indeed, that M. Montbeillard describes it to have twelve tail feathers, which bears out the above idea that it may be a true Hirundo, and shows that it cannot be a Swift. It was on drawings by M. Poivre that the Cuculus sinensis and C. paradiseus, Linn., were founded; the one representing a Corvidous bird (Psilorhinus), and the other a Drongo (Edolius), each represented with a reversed outer toe!

† "Linn. Tr.," xiii., 143.

‡ Burong, *i.e.*, bird.

§ Literally, blackbird.

‖ "Narrative of Macartney's Embassy," i., 287.

¶ See also Valentyn, as quoted in the "Bataviaasch Genootschap," iii., 247.

* J. A. S., xv., 363.

habitat for Collocaliæ in that island "on the banks of a river, thirty miles from the sea, in some eaves of a high mountain. A Chinaman rents them from Government, and pays £40 for a period of seven years. This man says there are two kinds of the bird, but does not know much about them. I will, if possible, visit the spot during the 'take,' which comes on four times a year, October being the forthcoming. This quadruple harvest would seem to imply that they do not migrate, as all other species [of swift and swallow] assuredly do." Our friend Captain Lewis, who saw much of these birds in the Nicobars, having opportunely returned to Calcutta after a long absence, we had an opportunity of submitting the accompanying notice of them to his criticism; and he states positively that he observed but one species in those islands, the C. fuciphaga, of which he preserved numerous specimens, both adults and young, from the nests, and remarks that they laid two or three white eggs, commonly the latter number, but he thinks he once observed as many as four. The number may, in fact, vary according to season (Captain L. observing them in the cold weather). He remarks that the gatherers of the nests are much given to mislead inquirers who interrogate them on the subject, which may account for the published statements that C. fuciphaga does not produce a valuable nest. The notice which we have given from M. Hooyman of the manners and building-places of C. nidifica he says applies equally to those of C. fuciphaga in every particular; and especially he has often remarked that they retire early in the afternoon to their caverns (*i.e.*, about four p.m.); but he states that the edible nests, as we see them, are only the lining, which comes out entire, though independently affixed to the rock, being underlaid by a network of some vegetable fibrous substance placed on the ledges, which the gatherers are careful never to remove. Further attention is invited to this subject.

FURTHER RESEARCHES ON ELECTRO-PHYSIOLOGY.

By M. CH. MATTEUCCI.*

I hope that the academy, which has always been pleased to encourage me in my researches upon electro-physiology, will permit me to communicate some new investigations upon this subject. I cannot commence the exposition of these researches without very briefly recapitulating the four principal points from which I started, and which, to a certain extent, form a summary of the whole of my former labours.

1. In each cell of the electric organ of fishes the two electricities become separated under the influence of the nervous action propagated from the brain towards the extremities of the nerves. A relation exists between the direction and the intensity of the nervous current, and the position and the quantity of the two electricities developed in the cell. In accordance with this relation which has been established experimentally, if, as was done by Ampère in the case of electro-magnetic action, we represent the nervous current by a man lying extended upon the nerve, and with his face turned towards the caudal extremity of the Torpedo or the dorsal surface of the Gymnotus, the positive electricity of the cell always exists on the left of the man: since each cell of the organ forms a temporary electric apparatus, this explains the position of the poles at the extremities of the prisms, and the intensity of the discharge being proportional to the length of the prisms, as established by experiment.

2. It has been shown by experiment that the greatest analogy exists between the discharge of electric fishes and muscular contraction. There is no circumstance which modifies one of these phenomena which does not act equally upon the other.

3. The contraction of a muscle developes in a nerve which is in contact with this muscle the cause by which the nerve excites contractions in the muscles through which it ramifies. Although experiment has not yet enabled us to decide whether this phenomenon is an instance of nervous induction, or a proof of an electric discharge developed by muscular contraction, we are led by all analogy to admit the second hypothesis.

4. The electric current modifies the excitability of the nerve according to its direction. The electric current, when propagated in the direction of the ramification of the nerve, destroys its excitability; when propagated in a contrary direction to the ramification, it augments the excitability of the nerve. The phenomena brought into play by the cessation of an electric current traversing the nerves of an animal depend upon the modification which the excitability of the nerve has experienced by the passage of the current, according to its direction. The same cause explains the voltaic alternations, *i.e.*, the muscular contractions excited by a current, which is made to traverse a nerve in a contrary direction to that in which it had ceased to produce any effect.

In this first extract I shall confine myself to communicating to the academy a result which I regard as fundamental to the theory of electro-physiological phenomena. By a very simple experiment, and one which is easily repeated, I have shown that an electric current which traverses a muscular mass in the direction of its fibres, and consequently in a direction which is normal or oblique to that of the ultimate nervous ramifications which are distributed through it, developes in these filaments a nervous current, the direction of which varies according to that of the electric current, relatively to the ramification of the nerve. This law is the same as that which establishes the relation between the direction of the nervous current and the position of the contrary electric conditions in the organ of electric fishes; in other words, it is the reaction of electricity upon the nervous force. In discovering a new analogy, and that the most intimate possible, between the electric discharge of fishes and muscular contraction, I have shown that, just as in the electric apparatus of the torpedo, the nervous current developes the two electricities in a determinate direction, according to its own direction. In a muscular mass the two electric states, diffused through the elements of its fibres, produce a current, the direction of which, varying with that of the electric current, is established, like the direction of the discharge in the torpedo, by that of the nervous current which excites it. I have taken every pains to establish by experiment this result, which I shall henceforth consider as the foundation of the theory of electro-physiological phenomena. Whatever may be the nature of the nervous force, of which we are ignorant, as of that of the other great natural agents, it is a fact that this force is propagated in the nerves sometimes from the brain to the extremities, sometimes in a contrary direction. It is entirely independent of hypothesis, and, in fact, in accordance with experiment to admit that in the act of muscular contraction excited by the action of the will, or by the stimulation of the nerve, a nervous current is propagated in the direction of the ramification of the nerve: on the other hand, the nervous current follows an opposite direction when sensation is experienced by the stimulation of the extremities of the nerve.

I have already shown in my former researches, and by direct experiments, the great difference between the nervous and the muscular substance as regards the conduction of the electric current. Regarding these experiments, which it would be impossible for me to describe here in detail, I shall confine myself to the account of one, the evidence afforded by which is perfect, and which may be applied to the case in point. This experiment consists in introducing the nerve of a very sensitive galvanoscopic frog into the interior of a muscular mass, cut with a knife in the direction of its fibres. On passing a tolerably strong electric current through the muscular mass, contractions are never excited in the prepared frog. In this case, besides the better conductibility of the muscular substances, we have for the production of the effect observed the great difference between the relative mass of the muscle and of the nerve. It is unnecessary to state that the contraction of the prepared frog occurs if the poles of the battery are closely approximated to its nerve, or if the muscular mass, by its contractions, produces the phenomenon called induced contraction. The experiment succeeds perfectly on taking the muscles of one of the mammalia or a bird, after their irritability has ceased; so that the passage of an electric current through these muscles does not excite any sensible contraction.

It is then proved by experiment that, when a muscular mass is traversed by an electric current, the nervous filaments diffused through the mass do not produce any sensible part of this current, so that the effects obtained can only be due to the direct action of the electric current upon the muscular fibre, and to the indirect action or the influence of the electric current upon the nervous force.

The following are these effects:—If, in a living rabbit, dog, or frog, we expose the muscles of the legs, by entirely removing the integuments, and pass an electric current from a pile of thirty or forty elements through these muscles, applying one of the poles to the upper and the other to the lower part of the leg—if the positive pole is placed above and the negative pole below, so that the electric current traverses the muscular substance in the direction of the ramification of the nerves, a very powerful contraction is produced, not only in the muscles of the leg, but also in those of the foot. If the current is passed in the contrary direction, the animal cries out from pain, the contraction is much less, and only occurs in that muscle which is traversed by the current.

On repeating these experiments many times and upon different animals, which I have taken care to do, we readily discriminate the principal results which I have described from those slight modifications which sometimes occur, especially at the commencement of the experiment.

These results can only be explained in one way. The very powerful contraction excited in the muscles of the leg and in the foot by the passage of the electric current proves the existence of a nervous current propagated from the extremities towards the centre, and developed under the influence of an electric current which traverses the muscular mass in the contrary direction to that of the ramification of the nerve.

As an electric current, when propagated through a muscle, never leaves the muscular fibre to follow the nervous filaments, we have perfect evidence that the nervous currents of which we have spoken are due to the influence of the electric states which are propagated in the muscle.

To demonstrate the entire importance of these conclusions, we only require to be made acquainted with their connection with the law of the electric discharge in fishes; this connection is as intimate as is possible. In fishes the electric discharge arises from the production of a nervous current by the stimulation of the nerve which is distributed in the organ. In the experiments which we have described a nervous current is produced by the electric discharge which is passed through the muscle. When this discharge is passed through the muscle in such a manner that the positive and negative electric states are disposed with regard to the nerves in the same manner as in the discharge of the electric fishes, a nervous current is produced by the influence of the electric current. This nervous current has the same direction in both cases; but in the discharge of the torpedo the electric states are produced by the animal, whilst in the experiment of the muscular contraction the nervous current is produced by the influence of the electric current.

When the electric current traverses a mus-

* From the *Comptes Rendus* for April 30, 1849.

eular mass in a contrary direction to that of the ramification of the nerve, it follows, from the facts which we have established, that the electric current developes a nervous current, the direction of which is opposed to that which it developes on traversing a muscle in the opposite direction. This is shown experimentally by the phenomena of sensation or of pain which are produced by an electric current traversing a muscle in the contrary direction to the ramification of these nerves.—*Phil. Mag.*

ON THE REFLEXIONS OF DIFFERENT KINDS OF HEAT BY METALS.

By MM. F. DE LA PROVOSTAYE and P. DESAINS.

Those philosophers who have been occupied with the study of heat seem to admit that the rays of different natures are reflected in the same proportion on polished metals.

On the other hand, the very precise experiments of M. Jamin agree with the formulæ of M. Cauchy to prove that the intensity of metallic luminous reflexion depends on the colour of the light employed. The numerous analogies which exist between heat and light scarcely admit of an essential difference on this head. The authors, indeed, are of opinion that they have in fact proved by experiment that this difference does not exist, and that the rays of heat of different natures are reflected in very unequal proportions on the same metallic mirror.

The plan adopted and followed by the authors is precisely the same as that previously followed in their "Researches on Metallic Reflectors." The source of heat was always a Locatelli's lamp; only they operated successively with the direct rays, and with the same rays transmitted, sometimes through a plate of natural sal gem, and at others with it smoked, and lastly through a lamina of glass 5 millimetres in thickness. The incidence of the rays being about 60°, the following results were obtained:—

Experiments Made with the Metal of the Reflectors of Telescopes.—The metal of the reflector employed reflected 0.80 or 0.84 of the direct heat of Locatelli's lamp. It reflected only 0.74 of the heat derived from the same source when modified by passing through a lamina of glass of 0.005 millimetre in thickness. Lastly, it reflected 0.82 to 0.83 of the same heat transmitted through sal gem.

Experiments with Silver.—The silver mirror reflected 0.95 to 0.96 of the natural heat, and 0.91 of the heat which had passed through 0.005 of glass.

Experiments with Platina.—The platina employed reflected 0.79 of the natural heat; 0.77 to 0.78 of the heat which had traversed sal gem; 65 to 66 of that which had traversed 0.005 millimetre of glass; and lastly, 83 of that which had passed through smoked sal gem.

Some experiments were also made with plates of gold and unpolished silver, which were employed by the authors in an investigation respecting the diffusion of heat. The proportion of the incident flow which these plates reflect back to the pole when it is placed in the direction of the regular reflexion is extremely different, according as the heat has previously traversed glass or sal gem.

It results from these numbers that the heat most transmissible through glass is reflected in smaller proportion on the various metals tried; and that the heat which is transmitted in larger proportion through smoked sal gem is reflected more abundantly upon the same substances. A marked consequence of these experiments is, that a bundle of heat rays reflected on a metallic mirror has generally a composition entirely different from that of the incident bundle, and that consequently it should not suffer the same loss in traversing diathermanous substances. This has been directly verified by the authors in the following manner:—

1. They determined the loss of intensity which the heat of a Locatelli's lamp suffered in traversing a lamina of glass of 0.005 millimetre in thickness.

2. The loss suffered by heat from the same source twice reflected on parallel mirrors.

In the first case the lamina of glass employed transmitted 0.44 of the incident heat; in the second only 0.33 to 0.34.

These two methods afford, then, concordant results; and the authors are of opinion that they have determined that, on a great number of metals, and probably on all, the different kinds of heat are reflected unequally, and that the reflexion on polished metals changes the proportions of the different kinds of heat which compose the incident bundle.—*Comptes Rendus*, Avril 16, 1849.—*Phil. Mag.*

ON THE MAGNETIC RELATIONS OF THE POSITIVE AND NEGATIVE OPTIC AXES OF CRYSTALS.

By Professor PLÜCKER, of Bonn.

*In a letter to, and communicated by, Dr. Faraday.**

Allow me, sir, to communicate to you several new facts which, I hope, will spread some light over the action of the magnet upon the optic and magnecrystallic axes.

1. The first and general law I deduced from my last experiments is the following one:—"There will be either repulsion or attraction of the optic axes by the poles of a magnet, according to the crystalline structure of the crystal. If the crystal is a negative one, there will be repulsion; if it is a positive one, there will be attraction."

The crystals most fitted to give the evidence of this law are diopside (a positive crystal), cyanite, topaz (both negative), and other ones, crystallizing in a similar way. In these crystals the line (A) bisecting the acute angles made by the two optic axes is neither perpendicular nor parallel to the axis (B) of the prism. Such a crystal, suspended horizontally like a prism of tourmaline, staurolite, or "red ferridcyanide of potassium," in my former experiments, will point neither axially nor equatorially, but will take always a fixed intermediate direction. The direction will continually change if the prism be turned round its own axis B. It may be proved by a simple geometrical construction, which shows that, during one revolution of the prism round its axis (B), this axis, without passing out of two fixed limits C and D, will go through all intermediate positions. The directions C and D, where the crystal returns, make, either with the line joining the two poles, or with the line perpendicular to it, on both sides of these lines, angles equal to the angle included by A and B; the first being the case if the crystal is a positive one, the last if a negative one. Thence it follows that, if the crystal by any kind of horizontal suspension should point to the poles of a magnet, it is a positive one; if it should point equatorially, it is a negative one. This last reasoning conducted me at first to the law mentioned above.

The magnecrystallic axis, I think, is, optically speaking, the line bisecting the (acute) angles made by the two optic axes; or, in the case of one single axis, this axis itself. The crystals of bismuth and arsenic are positive crystals; antimony, according to my experiments, is a negative one: all are unaxial.

II. The cyanite is by far the most interesting crystal I have examined. If suspended horizontally it points very well to the north, by the magnetic power of the earth only. It is a true compass-needle, and, more than that, you may obtain its declination. If, for instance, you suspend it in such a way that the line A bisecting the two optic axes of the crystal be in the vertical plane passing through the axis B of the prism, the crystal will point exactly as a compass-needle does. By turning the crystal round the line B you may make it point exactly to the north of the earth, &c. The crystal does not point according to the magnetism of its substance, but only in obedience to the magnetic action upon its optical axes. This is in full accordance with the different law of diminution by distance of the pure magnetic and the opto-magnetic action. If you approach to the north end of the suspended crystal the south pole of a magnetic bar, strong enough to overpower the magnetism of the earth, the axis B of the prism will make with the axis of the bar (this bar having any direction whatever in the horizontal plane) an angle exactly the same it made before with the meridian plane, the crystal being directed either more towards the east or more towards the west.

The crystal showed, resembling in that also a magnetic needle, strong polarity, the same end being always directed to the north. I think this may be a polarity of the opto-magnetic power. Two questions, too, may easily be answered:—1st. Is the north pole indicated by the forms of crystallization? 2d. Did the crystal obtain, when formed, its polarity by the magnetism of the earth? Between the poles of the strong electro-magnet the permanent polarity disappeared as long as the magnetism was excited.

I am obliged, by the new facts mentioned above, to take up my former memoir; I must reproduce it under a quite new shape. I will examine again the rock crystal, which, being acted upon weakly by a magnet, induced me to deny in that memoir what I ascertain now and what I thought most probable, as soon as I received the first notice of your recent researches. [That you will find in the memoir given to M. Poggendorff two or three months ago.] Perhaps the exceptional molecular condition of rock crystal, as indicated by the passage of light through it, will produce a particular magnetic action.

I should be very much obliged to you if you would give notice of the contents of my present letter to M. De la Rive when he calls on you, as he intended to do. I showed him several of my experiments when he passed through Bonn the 12th of May. The following day I obtained the different results mentioned above.

My best wishes for your health.

Very truly yours,

Bonn, May 20, 1849. PLUCKER.

* "Philosophical Magazine."

ON ANISOL AND ITS DERIVATIVES.

By M. A. CAHOURS.

Anisol presenting with respect to toluol (benzoène of M. Deville) the same relations of composition that phénol does to benzene, the author resumed the examination of this product, in order to complete his researches respecting the compounds of the anisic series.

It has been shown that anisol treated with fuming nitric acid exchanged two or three equivalents of hydrogen for two or three equivalents of hypoazotic vapour. There was, therefore, wanting in this series of the derivatives of anisol its first term, that is to say, that which would result from the replacement of one equivalent of hydrogen by one equivalent of hypoazotic vapour, and which the author calls in the nomenclature adopted for these compounds mononitric anisol. M. Cahours has succeeded in obtaining it by treating anisol with small portions of fuming nitric acid, taking care to keep the vessel containing the reacting substances extremely cold. Operating with these precautions, a thick liquid of a blackish-blue is obtained, which is purified by submitting it, at first, to repeated washings with slightly alkaline water, and afterwards by distilling it, having first digested it over fused chloride of calcium. Thus prepared, mononitric anisol is a liquid of an amber colour, and heavier than water. It boils between 503° and 507° F., and possesses an aromatic odour. Solution of potash, even when heated, does not alter it. Concentrated sulphuric acid dissolves it when gently heated,

and water added to the solution separates the product from the liquor unaltered. Treated with an alcoholic solution of hydrosulphate of ammonia, it is readily acted upon; sulphur is deposited, and the alcohol holds in solution a new organic base, which differs from toluidine only in containing two molecules of oxygen.

Mononitric anisol submitted to analysis yielded nearly—

14 eqs. carbon	84	54.90
7 eqs. hydrogen	7	4.57
1 eq. nitrogen	14	9.14
6 eqs. oxygen	48	31.39
	153	100.00

The substance thus formed differs from anisol by the substitution of one equivalent of hypoazotic acid for one equivalent of hydrogen, which justifies the name of mononitric anisol bestowed upon it.

The analysis of the new base formed by the action of mononitric anisol and hydrosulphate of ammonia leads to the formula $C^{14} H^9 NO^2$; it forms a crystalline salt with hydrochloric acid. As mononitric anisol is prepared with difficulty, M. Cahours has obtained only a small quantity of it, and he proposes to call it anisidine.

Benzene and binitric cumene being easily acted upon by hydrosulphate of ammonia, and transformed into nitric alkaloids, binitric anisol was submitted to the same reagent. By treating an alcoholic solution of binitric anisol with hydrosulphate of ammonia an abundant deposit of sulphur is obtained, whilst the alcohol retains in solution a substance which perfectly saturates acids, and forms with them crystallizable acids [salts?].

The new base thus formed crystallizes in long needles of a reddish-brown colour, possessing much lustre; it is insoluble in water, but dissolves readily in boiling alcohol, the greater portion separating on cooling. This alkaloid yields well-formed crystalline salts with sulphuric, nitric, and hydrochloric acids; some of them are perfectly colourless when pure.

The analysis of this substance indicated its composition to be:—

14 eqs. of carbon	84	50.00
8 " hydrogen	8	4.76
2 " nitrogen.....	28	16.67
6 " oxygen	48	28.57
	168	100.00

It will be observed that this substance differs from the preceding only in one equivalent of hydrogen being replaced by one equivalent of hypoazotic vapour; for this reason the author gives it the name of anisidine nitrée. This base forms with hydrochloric acid a colourless salt, crystallized in long needles, represented by the formula $ClH, C^{14} H^8 N^2 O^6$.

The chloroplatinate crystallizes in needles of a golden-yellow colour; its formula is, $ClH, PtCl^2, C^{14} H^8 N^2 O^6$; the nitrate has the form of prisms of considerable size, which are slightly soluble in water; the formula is, $NO^5, HO, C^{14} H^8 N^2 O^6$; the sulphate is very soluble in water; it crystallizes in very fine needles, grouped around a common centre; its formula is, $SO^3, C^{14} H^8 N^2 O^6$.

When toluol is treated with fuming nitric acid it forms two compounds, one of which is liquid, and is the mononitric toluol; the other is crystallized, and is the binitric toluol. When the latter was treated with an alcoholic solution of hydrosulphate of ammonia it yielded a very fine alkaloid, corresponding to anisidine nitrée, differing from it only by two equivalents of oxygen. This new alkali the author calls toluidine nitrée; its formula is, $C^{14} H^8 N^2 O^4$.

The number of alkaloids increases daily; their study affords results of great interest, and the hope may be entertained that those presented by nature may eventually be formed by art. M. Würtz has described two very remarkable alkalis obtained by the action of potash on cyanic ether, alcohol, and pyroxylic spirit; petinine, recently discovered by M. Anderson in the products of the distillation of animal matters, is to be added to the group. The strong ammoniacal odour, the manifest analogy of the properties of its salts, with those of the salts formed by the alkalis of M. Würtz, induced M. Cahours to suppose that petinine belongs to this series. Adopting the formula, $C^8 H^{15} N$, proposed by M. Gerhardt, from the analysis of the chloroplatinate, it will be seen that petinine is merely butyrammonia, $C^8 H^2, NH^2$. M. Anderson has also noticed in the oil derived from the distillation of animal substances some very volatile alkaline products, among which will probably be found the curious alkalis of M. Würtz.

When fuming nitric acid is made to react upon anisic acid, or nitranisic acid, binitric or trinitric anisol is formed, according to the proportion of the matters reacting and the duration of the reaction. Besides these two substances there is formed, and often in great abundance, an acid which crystallizes from an alcoholic solution as it cools in the form of rhomboidal plates of a magnificent golden-yellow colour. This acid, which M. Cahours calls chrysanisic acid, has a very remarkable composition: it is isomeric with trinitric anisol; consequently it is an homologue of picric acid (phénol trinitrée).

This acid submitted to analysis gave:—

14 eqs. of carbon	84	34.57
5 " hydrogen ...	5	2.05
3 " nitrogen	42	17.29
14 " oxygen	112	46.09
	243	100.

This acid, differently from all others of the same kind, forms a very soluble salt with potash. —*Comptes Rendus*, March 19, 1849.

THE CHEMICAL TIMES.

SATURDAY, JUNE 2, 1849.

DEFECTIVE EDUCATION OF THE CHEMIST AND DRUGGIST IN ENGLAND.

Several institutions have been established of late in this country having professedly for their object the advancement of the pharmaceutist. That these institutions have exercised a beneficial influence upon the educational status of the body of chemists and druggists it would be vain to deny; but, on the other hand, it must be admitted that this beneficial influence has been confined hitherto within very narrow limits indeed. No perceptible progress has, in fact, been made by the chemist and druggist in the study and knowledge of the principal department of his calling, viz., *practical chemistry*, and more particularly *chemical analysis*. It would not be too much to assert that the great majority of chemists and druggists in this country, highly educated though most of them are in other respects, are almost totally ignorant of the very rudiments of that science which forms the fundamental basis of their profession. It is this lamentable deficiency which enables the wholesale dealer to drive a flourishing trade with sophisticated drugs and chemicals, and to impose upon his purchaser with perfect impunity, to the great detriment of the public at large. Even the simplest methods of testing certain chemicals for the purpose of ascertaining whether they are pure or adulterated are unknown to many druggists in this country. To give an instance of the marvellous facility with which some of that body allow themselves to be imposed on, we had occasion lately to procure some sulphate of quinine; we went to an establishment of considerable pretensions; the article which was sold to us as sulphate of quinine was subsequently found to contain eighteen per cent. of sugar. Upon applying to the vender, we were candidly told that he had never examined the article, nor *was he practically acquainted with the proper method of testing its purity*. Now, the method of testing sulphate of quinine for sugar is exceedingly simple: the dissolving of the suspected salt in water, and adding to the solution exactly so much carbonate of potass as will precipitate the quinine, suffice to reveal the sophistication by the taste. And yet this simple method was unknown to a gentleman who ranks among the *higher* class of chemists and druggists, and whose attainments in other branches of his profession are certainly of no mean order. And the same may be said of a great many of even the best educated chemists and druggists in this country!

That this is a most deplorable state of things, and that it is high time to provide some efficient remedy for it, will be readily admitted; nor can it be denied that the institutions to which we alluded at the commencement of this article, and which were established for the express purpose of raising the educational status and the *practical* attainments of the chemist and druggist, have in a great measure failed to effect their intended purpose. This failure we would venture to ascribe in part to the nature of the course of study pursued at these institutions; it appears to us that general and practical chemistry and sound chemical analysis are not sufficiently attended to in that course—that these branches are, in fact, somewhat neglected to give a freer scope to the cultivation of *speculative* science. If the managers of these institutions would look to this, and introduce some alteration in the system hitherto pursued, they would confer a vast benefit upon the chemists and druggists, as well as upon the public at large.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION.

May 18.—Sir J. Boileau, Bart., V.P., in the chair. Rev. E. Sidney "On the Geographical Distribution of Corn Plants." Mr. Sidney first remarked that botany now included not only description and classification, but the physiology of plants, within which we may regard as a subordinate department the laws of their distribution according to soil and climate. This is not only important as a question of pure science, but includes questions of food, luxury, and commerce. The method he should follow is to describe:—1. The natural distribution and artificial extension of plants. 2. The ways in which the limits of their ranges are exhibited on the map of the globe. 3. Application to the cerealia, having made certain needful remarks on the cerealia themselves. 1. Natural distribution depends on physical influences affecting organization, in relation to peculiar organization. It is a mystery of creation that the majority of the species seem to have originated from particular centres of creation. The limits within which plants are found to be naturally distributed are called habitations. The peculiar spots adapted to their growth are called stations. There were also peculiar Floras. The whole surface in which a plant is known to grow may be termed its area. Stations and ranges are horizontal and vertical, and are determined by parallels of latitude and longitude, and by degrees of altitude. The space within the parallels of latitude which bounds the area of a plant with respect to its horizontal range is termed its zone; but when both horizontal and vertical range are included

it is termed its region. 2. Conditions of climate, particularly heat and moisture, seem to be the chief determining causes of the habitations and stations of plants. Temperature must be considered in three points of view—the mean temperature of the whole year in each place—extremes of heat and cold—mean temperature of different portions of the year. Lines which mark the places where the mean annual temperature is the same have been attempted to be drawn. They take a curved direction. Lines passing through a series of places having the same mean temperature of the year are called isothermal; similar lines passing through places having the same mean winter temperature are called isocheimal or isocheimenes. Those having the same mean summer temperature ars called isotheres. Perennials are principally regulated by isotherms, annuals by isotheres. Though it is not possible rigorously to determine a habitation or area, yet useful divisions have been made for reference and comparison. The surface of the globe is divided into eight botanical zones on each side of the equator, the old geographical division into three being inadequate. Mountains placed between the tropics, whose summits rise above the snow line, represent all these zones. 3. After these explanations, Mr. Sidney proceeded to group the cerealia, and to his main subject. What is a cereal, or corn-plant? Cereals are all grasses whose seeds are sufficiently large for the food of man. Almost all grasses, except, perhaps, bromus catharticus, are wholesome. Some have been reported injurious, but the effects on the stomach are merely mechanical from their roughness and bristles. The seeds of all grasses become poisonous when changed into ergot. The group is very extensive, but comparatively few have large seeds. Those that have, and are used as food, are divided into two groups—Northern European and Tropical. In the Northern European group are our cereals—wheat, barley, rye. Oats are a modern appropriation: the Trojan horses were fed on barley. Wheat and barley were probably natives of Mesopotamia and the banks of the Euphrates. A curious two-headed specimen was shown of wheat from the axis of vegetation branching or splitting into two. Many grasses in the North European group are locally appropriated. The Tropical group includes rice, millet, and maize, the last being the largest cereal in the world. With regard to their geographical distribution, this must depend on the mean temperature of the few growing months. The limit of the Northern cereals is comprised within the highest latitude of barley and the lowest of wheat, barley requiring the least and wheat the most heat. Wheat finds its best place of growth on the borders of the sub-tropical zone. It requires an isothere of 57°, but is not important till the isothere equals 60°. Its warmest limit is an isothere of 70°. In countries within the tropics it can only grow at altitudes where the climate corresponds with the sub-tropical and temperate zones. All discrepancies in exceeding the limits stated are accounted for by altitudes. The line of barley lies between isotheres of 46° and 50°. Wherever there is a double crop it is to be attributed to the variety and not to the climate. Allusion was next made to the curious Nepaul barley most ingeniously described by Professor Henslow in the "Kew Garden Miscellany." Oats grow within the boundary of wheat and barley. Rye, which feeds the greatest population next to rice, is best cultivated in the sub-arctic zone. It comes between wheat and barley. Of the Tropical cerealia, rice requires an isothere of 73½°, and much moisture. Maize requires an isothere of 66°. By these means we are able to trace on the map the approximate limits within which the cerealia are restricted. Two maps were shown in which these were traced; and though some may be found growing beyond these, yet, generally speaking, it would not be with advantage. In conclusion, remarks were made on the folly of attempting to act in opposition to fixed natural laws. For example, there seemed no ground for the expectation that maize can be advantageously grown, season after season, in this country. Still we cannot say whether some particular variety may not be found a little exceeding the established limits. Experiments, however, should be well tried on a small scale before proceeding farther. Nor is ours the most favourable country for wheat, but skill in husbandry has overcome great difficulties. It is important to remark that extremely minute and inappreciable difficulties in climacteric condition may throw plants into an unhealthy state, which condition might exist for a few years, though we could not appreciate them, and produce various destructive blights, as, for example, that of the potato, by bringing the plant into that state which renders it capable of being attacked by the fungus called Botrytis carpentis, which certainly seemed to be the proximate cause of the disease. After a few more allusions to the importance of the subject of "The Geographical Distribution of Plants," Mr. Sidney concluded by thanking the Rev. Professor Henslow for his assistance towards the lecture which he had delivered.

GEOLOGICAL SOCIETY.

May 16.—Sir C. Lyell in the chair. A paper was read "On some Tertiary Beds in the Island of San Domingo;" extracted from notes by J. S. Heniker, Esq., with remarks on the fossils by J. C. Moore, Esq. In the north-east part of the Spanish possessions in San Domingo an extensive tertiary deposit intervenes between the sea and a range of mountains of mica slate, which has been traced by Mr. Heniker for 100 miles from east to west and thirty from north to south. It is intersected by numerous rivers, which have cut deep channels through it, exhibiting the strata in perpendicular bluffs. From the lower beds, at an elevation of 2,000 feet above the sea, Mr. Heniker procured a rich collection of well-preserved shells; and from the upper many corals, echinoderms, fishes' teeth, &c. Of seventy-seven well-defined species of mollusca, Mr. G. B. Sowerby identifies thirteen with existing forms; five or six are considered identical with shells found at Bordeaux, Turin, Piacenza, or American miocene formations. All the species of foraminifera which were determinable, four in number, are found in beds of the same age; and the fishes' teeth belong to the Carcharodon megalodon, considered by Agassiz as very characteristic of that epoch. From these grounds Mr. C. Moore infers that the San Domingo deposits are of the same age. Though the relations between these beds and those of the American miocene are very slight, he conceives that the difference of latitude is quite sufficient to account for the difference in their faunas. Many of the shells bear a close resemblance to species now confined to the Pacific; and two of the fossils are identical with the Venus puerpera and the Phos veraguensis,—the latter of which has never been found but in the bay of Veragua. Sir C. Lyell had before shown that the Calyptrea costata, recent at Valparaiso, is found in the American miocene beds. The separation of the Pacific and the Atlantic into two zoological provinces has been considered by D'Orbigny and Sir C. Lyell to have been of high antiquity, probably as old as the commencement of the eocene period; yet from the above facts Mr. Moore thinks it highly probable that during some portion of that time a channel must have existed across the central part of America, by which some few of the mollusca have migrated from one ocean to the other. The physical character of the isthmus of Panama lends probability to this hypothesis; since, unlike the table-land of Nicaragua rising to 4,500 feet to the north, or the peaks of the Andes rising to 11,000 feet to the south, it consists of a narrow strip of low land studded with volcanic cones, the highest of which does not exceed 1,000 feet in height,—an elevation not half that through which the beds of San Domingo have been elevated since their deposition.

SOCIETY OF ARTS.

May 9.—W. Tooke, Esq., V.P., in the chair.—Mr. D. Wyatt read a paper "On Metal Work and its Artistic Design." He commenced with some remarks on the absolute necessity of the study of specific design, in order to confine the errant imaginations of artists within reasonable bounds, and in order fully to take advantage of all the natural properties, mechanical capabilities, and recorded experiences peculiarly belonging to all materials, in the elaboration of which it is requisite than an alliance between use and beauty may be effected. The author maintained that all propriety and perfection in manufacturing design were derivable from the result of such studies; and that the more clearly the objective individuality of every ingredient was preserved and enunciated in the finished article, the more satisfactory to both eye and mind would the character of its ornamentation appear. The specific design of metal-work was described as based on three great studies,—a thorough knowledge of which was requisite to all who would either manufacture, compose, or criticize in any one of its various ramifications. The first of these was that of the distinctive characteristics and appliances of each metal. The second, its form as modified by all the mechanical processes of manufacture. The third, a thorough analytical and critical acquaintance with all the best models in which reasonable and good principles of art can be traced, and through modifications of which pleasing associations of idea may be commanded at the will of the designer. In accordance with his scheme thus laid down, the author proceeded to deduce the correct theory of the manufacture of each metal from the properties with which it had been endowed by nature. He then described the process by which almost all objects in metal must be produced; dwelling on those best harmonizing with the character of each substance and the accredited conventionality of its use. Thus, he emphasized the refining, beating into sheets, wire drawing, stamping, and torsion of gold; the beating in a plate, gilding, dead silvering, parcel gilding, soldering, &c., of silver; the hollow casting of bronze by means of wax and of moulds, and the solid founding of iron in complex forms. Having disposed of the structural processes, the author analyzed the decorative or superficial; enumerating and sketching out the leading peculiarities of engraving—matting, niello, cooking, burnishing; the six chief divisions of enamel; and three or four varieties of damascening. The mechanical limits of the art being thus pointed out, the impressions suggested by the history of past chefs-d'œuvre were cursorily examined. The extreme antiquity of metal-work, and its details among the Jews, Egyptians, Assyrians, Persians, Greeks, Etrurians, and Romans, were demonstrated from descriptions furnished by various authors and by monuments of wonderful merit still existing. The speaker passed quickly over the mediæval portion of the subject; and concluded by calling attention to the beautiful examples by which he was surrounded, and urging a systematic recognition of first principles and practical details to be superadded to the study of beauty and fine art in the abstract.

ROYAL ASTRONOMICAL SOCIETY.

March 9.—"On Irradiation," by Professor Powell.

After adverting to the history of researches on this subject, the author dwells particularly on the method of exhibiting the phenomenon adopted by M. Plateau, which forms the basis of all his own experiments, and which consists of a card or lamina, cut so that one half of a long parallelogram is cut out whilst the other remains, having the portions at the sides cut away. Viewed against the light, the enlargement of the bright half, in breadth, is seen contrasted with the opaque, and might be subjected to measurement.

The first question on the subject refers to the supposition of a peculiar physiological cause affecting the eye to produce the enlargement of the bright image. After fully allowing for some portion of such phenomena being fairly attributable to ocular causes, such as dazzling, con-

trast, &c., experiments are adduced to show that precisely similar phenomena are produced in an artificial eye, or camera obscura; whence the hypothesis of any peculiar affection of the retina is rendered unnecessary. The same conclusion is further confirmed by photographic impressions of the image of the cut as before, which exhibit the same enlargement. Specimens of these impressions, taken by Mr. N. S. Maskelyne, were exhibited.

These results, clearly pointing to an optical cause, agree with the conclusions of the undulatory theory, relative to the "diffraction of a lens," as investigated by Mr. Airy, which apply to the eye considered as an optical instrument, as well as to the object-glasses of telescopes; in either case the image of a point being an extended disc, which, if the light be bright enough, will be surrounded by rings. A luminous surface will exhibit a like enlargement.

Without reference to any theory, it is an ascertained law that the enlargement increases with the intensity of the light. The enlargement also is formed with a rapid decrease in brightness towards the edge. On these grounds it is easy to explain the fact of the great diminution or total destruction of irradiation by the interposition of lenses, which would follow immediately from the weakening of the intensity in proportion to the square of the linear magnification. The author has examined particularly into the extent to which this effect takes place, and announces that low powers (from five to twenty) are sufficient to obliterate all irradiation even in the most intense light which the eye can bear.

Various results of M. Plateau and others as to the effects of contrast in making a narrow bar or wire continue visible, though the irradiations ought to overlap, have been examined, and found only to hold good with low intensities.

The author next considers the effect in telescopes. Here that portion of the effect which regards the ocular image being placed out of consideration from the influence of the magnifying power (already referred to), we have only to consider that part which affects the focal image of the object-glass. The diminution of the aperture increases the irradiation, but at the same time it diminishes the light. At a certain point, then, these two causes counterbalance each other, and no further enlargement takes place. This limit will vary with each instrument, and we have no certain grounds on which to determine it. Various observations are referred to in which its influence is evinced.

The astronomical facts connected with these causes are then examined from the testimony of various observers. In particular the application of these principles to some of those singular phenomena occasionally noticed in eclipses, transists, occultations, &c., seems easy in theory, abstractedly considered. The difficulty lies in explaining why they are observed only in some cases and not in others. The author dwells particularly on the desirableness of a closer attention to stating all the conditions of the telescopes employed, especially the apertures.

In particular the phenomenon "the neck," in the transits of Mercury and Venus, would be an obvious consequence of irradiation, which would diminish the planet's disc, and enlarge that of the sun except at the small portion of the circumference in contact, when the absence of both irradiations would produce a "neck."

Both theory and experiment show that a small dark disc would have for its image a diminished disc with a bright internal concentric ring, which, if the disc be very small, will be contracted to a central bright spot. This seems to agree with the appearance noticed by several observers in the transit of a white spot on the centre of the planet. On a former occasion, however, Professor Moll and others saw such a spot excentrical. The projection of a star on the bright limb of the moon would also be an effect of irradiation, which would cause the disc of the moon simply to overlap the star.

Lastly, the author suggests a method for obtaining measures of the amount of irradiation under any given light, by placing a card, cut as before, at the focus of a lens, opposite to the object-glass of a telescope, and attached to it by a short tube; when the enlargement of the image of the card, illumined by the light from any source, can be subjected to the exact measurement of the micrometer of the telescope.

PARIS ACADEMY OF SCIENCES.

A species of alum has for some time been used in manufacturing processes, which, according to the statements of those who have tried it, contains the useful properties of alum, both in dyeing and printing, in a very high degree of concentration, which renders it highly advantageous, and very considerably diminishes the expense of carriage. This alum has not the slightest external resemblance to the common potass alum, since there are no traces of crystallization in it; it is flat, or in square plates of from 25 to 30 millimetres in thickness. It is white, has not much transparency, and is very soluble in water. Its taste is not unlike that of common alum, but is much more pungent. When heated in a crucible it swells, and is afterwards resolved into a gummy substance. When exposed to a higher temperature it emits vapours, exhalting the smell of the vapour of sulphuric acid; yet the calcined mass is not less soluble in water than it was before its subjection to the action of fire. If pounded sulphate of potass is thrown into a concentrated solution of this alum, it quickly forms a saline crust of common alum. The usual tests show that this alum contains alumina and sulphuric acid; but no ammonia. By qualitative analysis a small proportion of potass is also found. Yet, in analyzing the constituent parts of alum to determine its value in certain practical applications, it is necessary to investigate the proportions of its elements with greater exactness. There is, in fact, but one method, viz., quantitative analysis, that can enable the practitioner to form a just estimate of the real value of a new substance, to ascertain its real advantages, and to guard against the attempts of cupidity and fraud. The analysis of the substance in question is not attended with any difficulty. 10.58 grammes of this alum yielded, with ammonia, an abundant precipitate, which, after appropriate treatment, weighed 1.472 grammes, which corresponds to 13.9 per cent. of alumina. 6.24 grammes of this alum produced, with salts of baryta, 6.55 grammes of sulphate of baryta, which corresponds to 36.24 per cent. of sulphuric acid. 7.22 grammes of the alum precipitated by ammonia, and kept on the filter until the fluid was entirely evaporated, left 0.200 of a residuum which resisted heat, and was found to consist of sulphate of potass; since, when placed in contact with tartaric acid, it reproduced from tartar the potass; and yielded with salts of baryta known precipitates. The quantity of this sulphate of potass amounted to 2.77 per cent. 7.22 grammes of the alum heated till in a state of complete fusion left 4.32 grammes of residuum, which, however, still contained water. At a still higher degree of temperature the weight of this residuum was reduced to 3.335, but with a slight disengagement of sulphuric acid. In order to correct these two latter results, which are above and below the average, a quantity of alum (the weight of which was ascertained) was mixed with oxide of lead, newly calcined; it was boiled in water, and was afterwards evaporated and heated to a high degree. In the course of this operation 4.01 of alum lost 1.99 of water, which is about 49.9 per cent. The composition of this alum may, therefore, be taken as follows:—

13.91	alumina,
36.24	sulphuric acid,
2.77	sulphate of potass,
49.60	of water.
102.52	

In this calculation the sulphuric acid contained in the small quantity of sulphate of potass is counted twice. Deducting 1.27 for the sulphuric acid contained in the sulphate of potass, the sum total of the constituent parts is reduced to 101.25. It is thus seen that the alum in question is, properly speaking, only a pure sulphate of alumina, with 18 atoms of the water of crystallization—a combination which, according to Berzelius's "Manuel de Chimie," has already been known, and which ought to tain 48.53 per cent. of the water of crystallization. The small proportion of sulphate of potass that is contained in it shows whence this salt arises. Probably this alum is prepared with clay, calcined and pulverized, and with unconcentrated sulphuric acid, which are boiled together in flat vessels on a hot fire, and which are cooled immediately. This occasions the uncrystalline appearance in which it is found in commerce. This alum is entirely free from iron, and is for a great many purposes a desirable substitute for common alum. It is admitted that the value of different alums is proportionate to the quantity of alumina that they contain. The alum in question contains 13.91 per cent. of that earth, while common crystallized alum contains only 10 per cent. The former, therefore, contains 3.1 per cent. more; which agrees with the 28.7 per cent. alumina of the potass alum. Consequently, if the new alum is from 28.7 per cent. dearer than the other, the two prices in relation to the quantities of alumina are equal—that is to say, the same quantity of alumina can be purchased for the same price. The new alum possesses an important advantage in the preparation of the mordant of the acetate of alumina; for, as it may be said not to contain any sulphate of potass, it follows that, in the decomposition by the acetate of lead, one fourth is saved of the quantity of salt previously used, since in common alum three atoms of sulphate of alumina are combined with one atom of sulphate of potass.

ON THE MANUFACTURE OF SUGAR FROM POTATO STARCH OR FECULA.

The fabrication of sugar from fecula by means of sulphuric acid has been carried to a great extent in France; partly because the price of potato starch is usually very low, and partly because the starch syrup has received an extensive and varied application.

The purposes to which it is principally applied are:—

1. The sweetening and strengthening of wine. (In a cask containing 50 gallons of wine, from 10 to 20 pounds of starch syrup are employed.)
2. Brewing (especially a species of pale beer).
3. Distillation of brandy.
4. Manufacturing vinegar.
5. Adulterating raw cane sugar.

M. Payen has published an instructive article on this subject. It has been calculated that if the manufacturer consumes daily three tons of potato starch, and obtains therefrom 4½ tons of syrup, his daily profits amount to 55 francs = £2 4s. In one establishment the boiling is performed by means of steam; in another over the fire, in large leaden boilers placed on iron plates of a convex form, and of the thickness of 15 lines = 1⅜ inch, in order to effect the gradual distribution of heat. One ton of water is first heated to the boiling point in these vessels, and 22 pounds of sulphuric acid of 60° Beaumé = 1.845 (previously diluted with twice its weight of water) added to it. The vessel is provided with a wooden cover, coated with copper, which has, near the rim, an opening of about 12 or 15 inches in width, thus allowing the liquor to be stirred by means of a wooden spatula; and through which, after the liquor begins to boil, about 8 cwt. of starch flour are gradually sifted in quantities of about 1 pound at a time, the liquor being kept stirred all the while; the formation of lumps is thus prevented, and the boiling uniformly continued.

In some of these manufactories the starch sugar, being mixed with water, is put in a vessel placed above the boiler, from which it flows into the boiling acid, in a uniform stream, by means of a tube; whereby the object sought—of a great quantity of the latter acting at once on a proportionately small portion of starch flour—is attained in a manner which admirably promotes the formation of sugar; and this operation is almost instantly effected as soon as the whole of the starch flour is carried down into the boiler; whilst, by the former way, according to which the whole of the starch was at once mixed with the liquor, the manufacturer was obliged to continue the boiling for twenty-four hours (repeatedly replacing the evaporating water).

At present the boiling is continued for not more than eight or ten minutes after the whole of the starch flour has been brought into the acid liquor, in order to convert the contents of the boilers into syrup, and to obtain an almost transparent, very liquid, solution, which, if tested with tincture of iodine, does not assume any violet colour; and which, if a sample be taken out, does not appear glutinous or lumpy. The fire is then regulated so that the liquor ceases to boil; and this, in the event of the boiling being caused by steam, is managed by closing a tap. Chalk is then added in about the same proportion as the concentrated sulphuric acid; that is to say, 22 pounds. Since, however, the chalk is not always of the same quality, the point of perfect saturation must be ascertained by tincture of litmus; a small excess of chalk is not prejudicial, and even advantageous, in order to be sure that the free acid is entirely removed.

It scarcely requires the remark from us that the chalk should be added carefully and slowly, on account of the violent evolution of carbonic acid. The liquor is removed from the sulphate of lime produced by filtering through a layer of triturated burnt bones, spread on straining-cloths in wooden filtering-frames. The sulphate of lime is finally used as manure, being first washed with water; and this water is afterwards used for another process. The filtered liquor is gradually brought into a flat pan, in which it is evaporated rapidly, until it is reduced to about one half of its volume, and to a strength of 22° or 25° of Beaumé = 1.176 to 1.205 specific gravity; after which it is, for the second time, heated to boiling with charcoal and bullock's blood, then fined and filtered. 100 parts of dry starch, or 150 of fresh, yielded 150 of syrup of 30° Beaumé = 1.256, equivalent to 100 parts of dry sugar, which is obtained by concentrating the syrup to 36° Beaumé = 1 324, decanting it into casks provided with taps, and slowly cooling it therein. At the expiration of two days the liquid syrup may be obtained by opening the taps, and the crystallized sugar is then found in the casks. In some manufactories the syrup is concentrated to from 40° to 50° Beaumé = 1.375 to 1.510, and then decanted into tinned copper vessels, where the sugar, on cooling, consolidates to a granular and compact mass, without assuming the form of regular crystals.

M. Payen states that two persons, relieving each other during the work, are able to boil five different quantities in twenty-four hours, and to consume 2,000 kilogs. = nearly two tons of starch flour, if the work is conducted alternately in two boilers.

In Burgundy, particularly, a considerable quantity of starch syrup is consumed, for the purpose of giving more body to wine. In manufacturing spirits of wine the starch sugar is to be preferred to the raw potato, enabling the distiller to obtain the spirit free from the empyreumatic oil with which it is otherwise contaminated. The sugar and syrup of fecula are also extensively applied to other purposes—for instance, sweetening made dishes, confectionery, &c.,—and also to the manufacture of blacking.

LIGHTING OF FACTORIES.

Various materials have been used for the manufacture of illuminating gas as a substitute for coal; but without success when brought into competition with coal, as it is evident would be the case, when it is considered that the material from which coal-gas is made really costs nothing; the coke or residuum from the coal being worth as much, or more, for many uses, than the coal previous to its being carbonized. The cost of the gas to the manufacturer being for labour, fuel, &c., with the interest or the cost of works.

The process of converting coal into coke, by the abstraction of the bituminous portion, is carried on extensively; the bituminous, or that portion which in coal-gas works is converted into illuminating gas, being wasted.

Why then, it may be asked, have other materials been used? In the early stage of coal-gas manufacture, before the art of purifying was understood, the offensive odour produced by sulphhydrate of ammonia, resulting from foreign substances, always contained in a greater or less degree in coal, prevented its use in dwellings. Oil was therefore substituted, to a small extent, for coal in generating gas; but its high cost, together with practical difficulties not seen at first, and which became more and more serious as the business advanced, caused such works to be abandoned, and the undertakings proved ruinous to those engaged in them. The following remarks on this subject are from the *Encyclopædia Britannica*:—

"Oil being decomposed at a loss of nearly fifty per cent., the conversion of it into gas, after a protracted but ineffectual competition with coal, has been gradually abandoned on the large scale, even in those places where, from the interest of the whale fisheries, there were the strongest inducements to foster the unfounded prejudices which prevailed for some time against the use of coal-gas. The exaggerated advantages which it was pretended would be derived from compressing oil-gas, and thus rendering it portable, served to prolong the gross delusion on the subject. Nor were these delusions fully removed until a demonstration was given of the failure of the scheme, in the decay of costly edifices and expensive apparatus, which, in defiance of all sober calculations, had been constructed for carrying it into effect.

"The capital expended upon oil-gas establishments is actually applied to reduce to the extent of thirty per cent. the intrinsic value of the raw material, which it was pretended to improve in an equal degree; add to this the loss of gas in the main pipes, which is found to be fully twenty per cent., and it follows that the light from oil-gas is obtained at twice the expense at which it may be procured immediately from the oil itself."

Rosin, a much less costly material, was made a substitute for oil in the manufacture of gas, and such works, though attended with a degree of success, have yielded gradually to coal-gas works, and we believe that all the gas-works in this city will soon use nothing else but coal.

An error formerly very prevalent, and which led to the use of rosin as a substitute for coal in the manufacture of gas, was that the amount of light afforded by illuminating gas was in direct proportion with its specific gravity. This law was deduced by the aid of the photometer, or by observing the depth of shadows cast by flames from gases of different specific gravities, within short distances. It is wholly inapplicable, however, when applied to general illuminations.

For example: a camphine (spirits of turpentine) or solar lamp, in the middle of an apartment 16 or 18 feet square, will not afford throughout the apartment half the light that an argand burner, consuming $4\frac{1}{2}$ feet of gas per hour, in a like situation, would afford; yet, if we test the two flames by the ordinary method above referred to, our conclusions would be in favour of the camphine or solar lamp.

From a series of careful experiments made with coal gas of sp. gr. 0.450, and rosin-gas of sp. gr. 0.800, it was deduced that the light-giving value of the latter, compared with the former, was as 88 37-100ths to 100.

The illuminating power of coal-gas varies very considerably in different establishments, as it is dependent upon the quality of the coal used, and the care taken in its manufacture. 100 cubic feet of gas made from the best coal requires for its combustion 170 cubic feet of oxygen. 100 cubic feet of gas from sperm oil requires 190 feet of oxygen. Assuming, with Dr. Henry, that the illuminating power is in proportion to the oxygen required, then their relative value would be as 170 to 190. The value of rosin-gas would be, by this mode of comparing, something less than that from oil.

If, however, we take into consideration the less offensive odour arising from coal-gas, and the greater whiteness of the flame, it would be, perhaps, not unfair to ascribe an equal value to the same quantity from whichever material produced, whether coal or rosin.

In North Carolina gas made from rosin would certainly be the cheapest, but in Pennsylvania and other states, where there is bituminous coal, why not use coal for the illumination of every city and village? We may, perhaps, live to see the time when houses in cities will be heated, as they are now illuminated; and this might well be done in connection with gas companies.—*Scientific American.*

ON THE CONSUMPTION OF SMOKE. GALLOWAY'S PATENT BOILER.

This admirable contrivance for effecting the consumption of smoke is the invention of Messrs. W. and J. Galloway, of Knott-mill Ironworks, Manchester; and a few days since we witnessed its successful operation on an extensive scale at the works of the Oxford-road Twist Company in the same town. The history of the smoke nuisance in Manchester is much too "black" for publication; but to such an alarming extent had it grown some three years since that the corporation (who were empowered by their local acts) determined to suppress it.

Accordingly, several of the largest manufacturing firms were cited before the authorities, and among others the Oxford-road Twist Company, from whose chimneys it was proved that for nine hours out of twelve dense volumes of opaque smoke were vomited. They pleaded in extenuation the expenses to which they had been put, the costly experiments they had made, and their unceasing, but ineffectual, endeavours to abate the nuisance complained of; that they had instituted a system of rewards and fines with their stokers, in order to induce careful and efficient firing; in short, that, under the circumstances, they had attempted every scheme which appeared to be practicable; that the corporation might depend that their efforts would not be relaxed upon the subject; that any suggestion made they should be happy to adopt; and, if the nuisance could be remedied by the introduction of new boilers, they should not hesitate to incur the expense, if convinced of its practical value. This was the universal plea of all parties cited by the corporation, and it was just at this smoky aspect of affairs that Galloway's boilers "came out." The Messrs. Cooke, of the Oxford-road Twist Company, tried one as an experiment, and the results were so satisfactory as to induce them at once to adopt it, and they have now six large boilers on Messrs. Galloway's system at work. The practical operation of Messrs. Galloway's boilers has proved the incorrectness of the universal theorem of "smoke doctors," who maintain that smoke cannot be consumed without extra consumption of fuel, for we find that the consumption of fuel with Galloway's boilers has diminished to a remarkable extent—so much so that 70 tons of coals per week perform an amount of duty equal to that effected by 100 tons under the old system; in addition to which, the smoke and carbonaceous products are effectually consumed. The construction of this boiler is exceedingly simple; its shape is cylindrical, and it is furnished at the front or firing end with two separate internal flues, having a water space between them. These flues extend the length of the grate bars, and gradually converge into

one central flue, which traverses the remainder of the boiler. The *modus operandi* consists in firing each fire-grate alternately, by which the dense smoke and carbonaceous products of the newly made-up fire rush beyond the bridge of the furnace to the central flue, where they are brought in contact with the heated air and flame of the other fire, and are effectually consumed. An important feature in the arrangement of this boiler consists in the absence of all valves, dampers, or other contrivances, to effect the admission of air to the fuel, the air being supplied through the grate bars alone in the ordinary manner. Some three hundred of Messrs. Galloway's boilers are now at work in various parts of the manufacturing districts, affording results equally satisfactory; but we do not remember to have seen any boilers fitted up in so substantial a manner as those of the Oxford-road Twist Company. The Messrs. Cooke have been at more than usual pains to test the capabilities of the invention, and the effectual consumption of smoke is the result. Their assiduity and attention are largely beneficial, not only to themselves, but to the surrounding neighbourhood; while their courtesy in affording information on so important a subject must not be lost sight of. Recently, Messrs. Galloway have patented some further improvements in their boiler, by interposing a series of vertical tubes between the upper and lower surfaces of the back flue, which tubes are admirably effective in generating steam, and increasing the duty performed by the boiler; while another improvement consists in making fire-grates and flues within, instead of beneath, the tubes of the ordinary French boiler.—*Patent Journal.*

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—When society in days of yore was in the leading strings of a dominant priesthood, who could speak with an irrevocable fiat, the doings of the Medical Protection Society might at least be quietly submitted to, though repugnant to the sound judgment of intellectual minds. But in the present era tyranny cannot quietly yoke a burden so intolerable upon the liberty of Englishmen.

The chain must be better forged, the links better tempered than any which the medical tradesman have manufactured to bind securely the *ipse dixit* of a section upon the great and respectable body of the nation. Though the persecuting spirit be supported by council and inquisitors, it may yet be subjected to the exposure of its great Italian type, and soon be laid, like "Hamlet's" *Ghost.* This is the period of liberty, and revolution and anarchy quickly succeed every endeavour to destroy it. Kings are hurled from their thrones with as little ceremony as beggars are repulsed from the door; and does the Medical Protection Society, as a usurping monarch of the medical profession, suppose that it can sway the liberties of the British subjects with impunity? Does the monster think that it can devour the chemists and druggists, the surgeons, the physicians, &c., and, forsooth, digest them? Such amazing powers would truly entitle it to public exhibition, and the £1,500 expended by one of its hydra-heads soon be refunded. Does this society of conspirators suppose that it can deprive the poor of the valuable assistance of a chemist from whose advice he has frequently derived benefit? Does it suppose that it can drive the community to an L.S.A. for the dispensing of prescriptions? Is it really sincere in pronouncing the chemist "an ignorant quack," in opposition to the experience of the nation? Can it be true?

Its transactions in the cases of Dr. Lobo and of Mr. Wells are monumental of the infatuation of these protectionists. Must the British lion arouse itself and shake off these vertebrated disturbers of its peace?

They are not so closely sheltered in its coat, nor protected by its locks, but an unguent or lotion could be prescribed by the despised chemists which would effectually rusticate these creepers. They are already become too troublesome to tolerate. Something ought to be done at once: the time has come for action. Let an application of the following prescription be made, and depend upon it the funeral dirge of the Medical Protection Society must sound and reecho upon every hill of the United Kingdom, till distance swallows up the echo left, whilst the act of 1815 must be repealed to destroy these vipers' eggs.

My prescription is a compound of three valuable ingredients, and I should like the Medical Protection Society to say whether it is suitable for the public benefit:—

1. As stated in former numbers of your valuable journal, let every chemist determine and register his determination to employ no L.S.A. who would not sign a public protest against the Medical Protection Society, and all such interferences; and to influence his friends and customers to do the same to the utmost of his ability.

2. Every chemist should provide himself with a memorial, to be signed by his customers and friends, so that the mind of the nation be obtained. These memorials should state the liabilities of chemists to prosecution, the late cases, &c. They should lie on every chemist's counter. They should be the result of district exertion, and not be left to a London committee.

3. That an assurance society be incorporated, called the United Protection and Provident Association.

It should comprise chemists, physicians, surgeons, accoucheurs, holders of Scotch, Irish, and foreign diplomas.

Subscription of members £2 per annum, 10s. 6d. entrance fee. Fund to be invested in good security. Money to be advanced to any member in case of prosecution. Division of profits every five years. On the death of a member subscription money to be paid to his heirs or executors, subject to deduction, &c., if he has been prosecuted, amount of prosecution to be deducted from the returnable money, and the balance only be paid. The interest due next division day ensuing, and the entrance fee, sunk for the benefit of the society, &c.

The above is my prescription, and if it is correctly dispensed, and applied with care and assiduity, this inveterate plague will at once be stayed.

Perhaps some of your readers will furnish a copy of memorial in the pages of the *Chemical Times.* I am yours, &c.,

M.D.

℞. No employment of L.S.A.
Memorials.
Assurance Society.
M. ft. unguent. sap. mollis et applicand. bene.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

William Wilkinson, of Farrow, near Gateshead, in the county of Durham, coke-manufacturer, for certain improvements in the construction of coke ovens, and in the machinery, or apparatus, to be connected therewith. Patent dated November 16th, 1848. Enrolled May 16th, 1849.

This invention relates, first, to improvements in the construction of coke ovens, whereby the patentee is enabled to regulate and distribute the necessary supply of air for the proper charring of coal, in a more uniform manner than has hitherto been done. The air being distributed equally over and through the incandescent mass, the combustion proceeds with greater regularity.

The second improvement consists in the adaptation of machinery or apparatus to the working of coke ovens, whereby the patentee is enabled to economize labour, and consequently to cheapen the expense of manufacture.

The third part of the patentee's improvement relates to the application of the heat dissipated in the manufacture of coke to the evaporation of saline solutions.

With reference to the supply of air for the purpose of properly supporting combustion of the coal in coke ovens, the patentee constructs his ovens with flues in the brickwork, which flues pass all round the ovens on a level at about the spring of the arch or roof of the oven; from these flues a number of openings are made direct into the ovens, so as to distribute the air equally throughout the entire mass. The entrance of the air-flues are fitted with valves, or doors, by means of which the supply of air may be regulated. The proportions of the ovens which the patentee prefers for the purpose are: length, fourteen feet; breadth, eight feet; depth, from the sole or floor of the oven to the spring of the arch or crown, three feet; the radius of the semicircular arch is four feet. The floor of the oven is raised one foot from the ground. The door is of the full width of the oven, and in height is carried to about the spring of the arch; it is made of an open framework of iron, filled with firebrick; and when used is raised or lowered by means of a tackle suspended from a pair of shears erected over each oven.

With reference to the machinery for working the ovens, it consists of two rectangular plates, fitted to recesses in the back of the oven, through which two rack-bars fixed thereto pass; these rack-bars are equal in length, and project behind the ovens a distance equal to their length. They are supported on guide rollers in a horizontal position, and take into pinions on a shaft lying transversely across the whole range of the ovens, and driven by a steam-engine, or other suitable power; the pinions are fitted to the shaft in such a manner that they can be readily thrown in or out of gear with the racks.

This apparatus is for the purpose of projecting the coke out at the front of the oven after it has been sufficiently coked, obviating thus the labour of withdrawing the coke by hand. The two discharging plates are placed side by side in the oven, and extend nearly across the oven, while their depth is about a foot. As before mentioned, the door is of the full width, to admit of the egress of the coke; and, in order to facilitate the operation, the floor is inclined about six inches towards the front. The discharging plates are recessed into the back wall of the oven, into which they are withdrawn during the process of coking, in order to protect them from the heat; they remain here stationary until ready for discharging, when the pinion is thrown into gear with the rack. Throughout a range of coke ovens this discharging would necessarily be regulated to take place at different periods in each separate oven.

With regard to the third improvement—which refers to the application of the waste heat from coke ovens to the evaporation of saline fluids—this consists in the arranging a number of coke ovens in a manner that they may be in operation in separate series, and placing therein flues, through which the heated, incombustible, and unconsumed gases pass, in connection with flues running under the evaporating pan, which is represented as being the entire length of the range of the coke ovens. At the ends of these flues small auxiliary furnaces are placed in order to heat the flues, and also to ignite the gases passing off from the ovens. A concentrating pan is placed in connection with the evaporating pan by means of a syphon tube, the concentrating pan being on a lower level; at one end is a receptacle into which the resulting crystals are drawn; and at the opposite end a set of furnaces, by which the concentration is regulated to the degrees best adapted to promote the crystallization. Throughout, the flues under these pans are furnished with air passages, by which atmospheric air is admitted, and so regulated by dampers as to ensure the complete combustion of the gases. The ovens should be arranged for

charging and discharging in sets of four (supposing sixteen to be the number in the range), so as always to maintain the proper temperature in the flues for the requisite evaporation.

The patentee claims, first, the improvements described in the construction of coke ovens, by forming in the walls thereof flues, with lateral openings, for the purpose of supplying air to the interior of the oven, and equally diffusing the same over the surface of the ignited mass.

With reference to the machinery connected with the working of coke ovens he claims the mechanical means described, or any analogous arrangement, for discharging the coke from the oven. He also claims the mode described of economizing the heat given off from coke ovens during the manufacture of coke, and applying it to the evaporation of saline solutions, as also described.

Thomas John Knowlys, of Heysham Tower, near Lancaster, Esquire, for improvements in the application, removal, and compression of atmospheric air. Patent dated November 2d, 1848. Enrolled May 2d, 1849.

The improvements in this specification relate to the application and removal of heated air in the roasting of coffee, chicory, or such other matters as are used in combination with, or as a substitute for, the same.

The patentee asserts that in the ordinary manner of roasting these articles the process is conducted in close chambers, and consequently without any circulation of air, so that the pernicious vapours evolved during the process are not suffered to pass off, but remain in the roasting cylinder or chamber, to the detriment of the berry. For the purpose of roasting coffee the patentee employs a cylinder or hexagonal chamber of earthenware, which is thickly perforated with holes, of a diameter less than the size of the berry to be roasted; one of the six sides is on hinges, and used as a door for introducing and removing the coffee. This cylinder is placed in an oven, heated externally by a furnace, or other suitable means, the cylinder being mounted within it on an axis, on which it receives a slow rotary motion; the ends of the cylinder should also be perforated like the circumference. The oven has a passage from it in communication with the flue of the furnace, thereby creating a draught therein; and, air being admitted to the oven, a continual circulation is maintained, which carries off the vapours evolved by the coffee berry, or other equivalents.

In his improvements in furnaces the patentee calls attention to a patent of prior date (which he obtained in conjunction with Mr. Fillis), for improvements in furnaces; in which, instead of fire bars, the fire was placed on a hearth, or sole of fire tiles, or clay, and without any perforations for the admission of air, and in which the fire burnt from the top. Now, the present improvement consists in the furnishing such furnaces with a number of slits or perforations. The fire burning from the top passes down through the bed by these slits or perforations, and thence fulfils the purposes of heating required.

The patentee does not claim the burning of fuel from the top downwards, as this has been effected already before with fuel placed on bars; but he claims the placing of the fuel (for the purpose of top-burning) on or against the surface of fire tiles, having slits or perforations in them.

The third improvement relates to the compression and application of air through the fire bars of a furnace in which anthracite coal is consumed; for this purpose the patentee employs hollow bars (such as have before been used for a like purpose), through which he forces the air, either by a pump or some other suitable means. The air thus introduced keeps the bars cool on which the anthracite coal is burning, and, should an intense heat be required, the heated air may be allowed to pass out at perforations made in the bars, and become diffused amongst the ignited coal; or it may be conveyed away, and applied to such other purposes as it may be required for.

The patentee claims:—

The improved means hereinbefore described for the application and removal of heated air in the roasting of coffee, chicory, or other matters used with, or as a substitute for, such articles; and the material and construction of the requisite apparatus for the same.

Secondly. The improvements described in the construction of furnaces.

Thirdly. The forcing or compressing air through the bars of a furnace, in which anthracite coal is in a state of combustion, for the purpose of keeping the bars cool, and obtaining a supply of heated air, which may be used as described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MAY 24TH, 1849.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in weaving. Patent dated May 22d, 1849; six months.—(Communication.)

Francis Edward Colegrave, of Brighton, gentleman, for improvements in the means of communicating between the passengers and guard of a railway train, or between the guard and engine-driver, parts of which improvements are also applicable to working signals on railways. Patent dated May 22d, 1849; six months.

Solomon Israel da Costa, of Great St. Helen's, in the city of London, civil engineer, for improvements in vessels for holding solids or fluids, and in machinery for manufacturing such vessels. Patent dated May 22d, 1849; six months.

Rees Reece, of St. John-street, Smithfield, and Astley Paston Price, of Margate, chemists, for improvements in the manufacture and refining of sugar or saccharine matters. Patent dated May 24th, 1849; six months.

Andrew Crosse, of Gloucester-place, New-road, Esquire, for improvements in tanning hides and skins, and also in dyeing fabrics and substances. Patent dated May 24th, 1849; six months.

Thomas Goodfellow, of Tunstall, in the county of Stafford, earthenware-manufacturer, and George Goodfellow, of Shetton, in the same county, potter, for improvements in the method or methods of preparing plastic materials for manufacturing purposes. Patent dated May 24th, 1849; six months.

Andrew Smith, of St. James's, in the county of Middlesex, engineer, for improvements in machinery for, or methods of, manufacturing rope and cordage; and improved modes of fitting and using the same. Patent dated May 24th, 1849; six months.

Frederick Steiner, of Hyndburn, near Accrington, Lancaster, Turkey-red dyer, for improved processes and apparatus to be used in the Turkey-red dye on cotton and its fabrics. Patent dated May 24th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND FROM APRIL 21ST TO MAY 22D, 1849, INCLUSIVE.

Meyer Jacobs, of Spitalfields, Middlesex, gentleman, for certain improvements in the manufacture, stamping, and treatment generally of woven fabrics of all kinds. Sealed April 25th, 1849; four months.

James Roose, of Darlaston, in the county of Stafford, tube-manufacturer, and William Haden Richardson, the younger, of the same place, tube-manufacturer, for improvements in the manufacture of tubing. Sealed April 30th, 1849; six months.

Robert Oxland, of Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. Sealed May 4th, 1849; six months.

Frederick Steiner, of Hyndburn, near Accrington, in the county of Lancaster, Turkey-red dyer, for improved processes and apparatus to be used in the Turkey-red dye on cotton and its fabrics. Sealed May 7th, 1849; six months.

John Dalton, of Hollingsworth, in the county of Chester, calico-printer, for a certain improvement or certain improvements in printing calicoes and other surfaces. Sealed May 9th, 1849; six months.

Alexander Munkittrick, of Manchester, in the county of Lancaster, merchant, for an improved composition of matter which is applicable as a substitute for oil to the lubrication of machinery, and for other purposes. Sealed May 10th, 1849; six months.—(Communication.)

James Anderson, of Abbotsford-place, in the city of Glasgow, North Britain, starch-manufacturer, for a certain improved mode of separating different qualities of potatoes and other vegetables. Sealed May 10th, 1849; four months.

Alexander Swan, of Kirkcaldy, in the county of Fife, manufacturer, for improvements in heating apparatus, and in applying hot and warm air to manufacturing and other purposes where the same are required. Sealed May 14th, 1849; six months.

Samuel Adams, of West Bromwich, in the county of Stafford, organist, for improvements in mills for grinding. Sealed May 16th, 1849; six months.

Daniel Miller, of No. 168, St. George's-road, in the city of Glasgow, Scotland, civil engineer, for certain improvements in the mode of drawing ships up an inclined plane out of water, for which mode a patent was granted to the late Thomas Morton, of Leith, shipbuilder, on the 23d day of March, 1819, and which mode has been commonly known as "Morton's slip." Sealed May 21st, 1849; four months.

Alphonse Garnier, of Paris, in the Republic of France, but now of South-street, Finsbury, in the county of Middlesex, merchant, for certain improvements in extracting and preparing colouring matter from orchil. Sealed May 21st, 1849; four months.

Rees Reece, of St. John-street, Smithfield, and Astley Paston Price, of Margate, in the county of Kent, chemists, for improvements in the manufacture and refining of sugar or saccharine matters. Sealed May 21st, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND FROM THE 20TH DAY OF APRIL TO THE 20TH DAY OF MAY, 1849, INCLUSIVE.

Felix Alexander Testud de Beauregard, of No. 17, Rue St. Quentin, Paris, engineer, for improvements in generating steam, and in the means of obtaining power from steam-engines. Sealed April 27th, 1849; six months.

Thomas John Knowlys, of Heysham Tower, near Lancaster, and William Fillis, of Shirley, in the county of Hants, mechanician, for improvements in generating, indicating, and applying heat. Sealed May 10th, 1849; six months

Samuel Brown, the younger, of Lambeth, in the county of Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids and substances in a running state; which apparatus are in part also applicable to motive purposes. Sealed May 15th, 1849; six months.

John Smith, of Hare Craig, Dundee, North Britain, factor to Lord Douglas, of Douglas, for improvements in the manufacture of flour, applicable in the making of bread, biscuit, and pastry. Sealed May 18th, 1849; six months.

PATENTS RECENTLY EXPIRED.

A. Dumoulin, Middlesex, merchant, for certain improvements in gas apparatus. Patent dated May 19th, 1835; expired May 19th, 1849.

W. Patterson, Dublin, gentleman, for a new material for tanning hides and skins, which is also applicable to other purposes. Patent dated May 20th, 1835; expired May 20th, 1849.

TORTOISE SHELL.—Tortoise shell, or rather scales, is a horny substance that covers the hard strong covering of a bony cotexture which encloses the Testudo imbricata, Linn. The lamellæ

or plates of this tortoise are thirteen in number, and may be readily separated from the bony parts by placing fire beneath the shell. They vary in thickness from one eighth to a quarter of an inch, according to the age and size of the animal, and weigh from five to twenty-five pounds. The larger the animal the better is the shell. This substance may be softened by the heat of boiling water; and, if compressed in this state by screws in iron or brass moulds, it may be bent into any shape. The moulds being then plunged in eold water, the shell becomes fixed in the form imparted by the mould. If the turnings or filings of tortoise shell be subjected to gradually increased compression between moulds immersed in boiling water, compact objects of any desired ornamental figure or device may be produced. The soldering of two pieces of seale is easily effected, by placing their edges together, after they are nicely filed to one bevil, and then squeezing them between the long flat jaws of hot iron pinchers, made somewhat like a hairdresser's curling-tongs. The pinchers should be strong, thick, and just hot enough to brown paper slightly without burning it. They may be soldered also by the heat of boiling water, applied along with skilful pressure. But, in whatever way this process is attempted, the surfaces to be united should be made very smooth, level, and clean: the least foulness, even the touch of the finger, or breathing upon them, would prevent their eoalescence.

Royal Arsenal, Woolwich, May 29.—The gun-carriage invented by Captain the Hon. W. E. Fitzmauriee, Royal Navy, is to be tested shortly at the butt by being fired from. The origin of the plan about to be tested by the select eommittee at Woolwieh has been claimed by Lieutenant-Colonel William Henry Rochfort, Artillery Liberating Army of Portugal, late H.E.I.C.B. Artillery, who states that in the year 1831 the plans and models of a new gun-carriage were prepared by him, and submitted for exhibition before Sir James Kempt, then Master-General of the Ordnance, by whom the lieutenant-colonel was referred to the late General Miller, at Woolwich. General Miller declined to recommend the alterations proposed, alleging they were too radieal, and would be too expensive, and, therefore, they could never answer. Lieutenant-Colonel Rochfort admits that his plan comprised the substitution of iron for wood for all calibres and all classes of earriages, a perfectly diffcrent and not removable trail-handspike, and a quadrant indented under the breech of the gun, with a toothed pinion and handle to give the officer or gunner the means of directing the gun alone with greater facility to the right or left, as occasion may require, without having reeourse, as is now the casc, to handspikes, whereby the carriage itself has to be moved, *toto pondere*, altogether. A plan similar to Lieutenant-Colonel Rochfort's was tried at the Royal Arsenal during the time General Miller was Director-General of Artillery, having a fixed trail-handspike attached, for directing the gun, which was designated "the monkey tail," from the position it oceupied. Captain the Hon. W. E. Fitzmaurice's plan has nothing of that kind, the movements being given by a cross handle, similar, but much smaller, to the steering-wheel of a vessel, and by this principle he moves the gun-carriage, quoins, and everything, *toto pondere*, just as it is delivered from the Arsenal, and only requires the addition of four picees of timber, and a rack and pinion, which eosts six shillings. It is immaterial to Captain Fitzmaurice's plan what size or length the gun is, as the carriage increases in proportion, and is made the main power, it eomposing the lever, which ean be worked easily with one hand. It may be stated that none of the offieers who have seen Captain Fitzmaurice's plan have ever witnessed anything of the kind before, although the principle of moving the gun in the segment of a eirele was known long antecedent to either of the inventions.

Rather Startling.—It is stated by our Manchester correspondent that considerable quantities of yarns have been sent from that plaee to Elberfeld, in Germany, for the purpose of being dyed Turkey red. On its first being stated it was deemed scarcely credible, but a farther and more intimate inquiry, in quarters sure of knowing whether it was the fact, has left no doubt of such being the case. Our eorrespondent did not hear any other reason assigned for so unexpected a competition, but that the priee eharged will bear the expense of transit to and fro. It is probable, he thinks, that a superior dye may have led to so unlooked-for an event. In this case the cotton Turkey-red dyers in Manchester must look about them.—*Leeds Mercury*.

Invention for Stopping Steam-Engines.—A Bradford eorrespondent of a morning paper says:—"Through the kindness of Messrs. Smith and Booth, manufacturers, Southgate, we have had an opportunity of witnessing on their premises the working of a simple piece of maehinery by means of whieh a steam-engine of 30-horse power was stopped almost instantaneously. We were taken to one end of a spinning-room when the machinery of the whole mill was in full operation, with the steam-engine at full speed; when a valve was opened that admitted the atmospherie air, whieh instantly choked the eondenser of the engine, shut off the throttle and water valves, and opened the blow valves. The instant this was done the fly-wheel only made one revolution and a quarter. In the ordinary manner of stopping the engine the fly-wheel makes five revolutions before it ean be brought to a stand. So complete is this simple pieee of mechanism that although the whole machinery throughout the mill is stopped so suddenly not a single thread is broken, but all remains ready for resuming work when the engine is again set in motion. This pieee of machinery, which we may term a safety-valve, may be placed in any room of the mill or on any part of the premises, or even off the premises, and by the means of pipes it can be made to have the same effect as if within a yard of the engine itself; so that if an aceident happens, such as an overlooker or other person being caught with one of the mill straps and drawn up to go round the shaft, by using this mode of stopping the engine, before he eould by any possibility come in eontact with the shaft, the whole maehinery would be brought to a standstill and his life saved. This useful discovery is the invention of James Mills, of Horton, the engine-tenter at the mill in which it is now in operation, and refleets the highest credit on his ingenuity as a hard-working mechanic. A patent has been sealed for it in the name of Mr. G. E. Donisthorpe and James Mills: Mr. Donisthorpe carrying the invention out more fully, viz., to high-pressure engines, waterwheels, &c. The expense of fixing the machinery in connection with the invention in manufactories will be about 10s. each horse power."

Births and Deaths during the Week ending May 26.—The return of the registrar-general for the week ending the 21st inst. shows an improvement in the general health. The number of deaths from all causes amounts to 897; of these the fatal eases of cholera are,—Westminster, St. John the Evangelist, F. 39, "cholera (12 hours);" St. James, Golden-square, F. 27, "common or English cholera (4 days)." Marylebone, All Souls, M. 4 months, "diarrhœa cholerica (3 days);" F. 1, "diarrhœa cholerica (14 days)." Hackney, at the German Hospital, Dalston, the wife of a tailor, 56, "eholera (18 hours)." The number of births is 1,311.

Caution to Artists.—Mr. A. F. West, a young artist, died on the 23d of last month; and, after a *post-mortem* examination, a jury returned a verdiet, "That the deeeased died from the effects of earbonate of lead." It appeared that he was in the habit of drawing his brushes through his lips.—*Builder*.

An ingenious application of elcctricity has been made by Mr. Arthur Dunn, by means of which signals are given that indicate the pressure of steam in the boiler of an engine. Tubes being filled with mercury are made part of a galvanie circuit, and connected with bells as the mercury rises from increasing pressure in the boiler; the circuit is thus completed, and the bells respectively rung indicate the amount of pressure. In this way attention is called to the eondition of the steam the moment it exceeds its ordinary and safe working condition.

Among other things to which gun-eotton is to be applied, we now learn that Count de Werdinsky has patented a locomotive engine which is to be worked with entire freedom from explosion by igniting small portions of this substanee underneath the piston in its eylinder.

TO CORRESPONDENTS.

"A Constant Reader."—Burning pastils are prepared as follows:—

Take of Benzoin, 16 parts.
Tolu balsam,
Citrin sandal, of each 4 parts.
Labdanum, 1 part.
Light charcoal, 48 parts.
Nitrate of potass, 2 parts.
Gum tragacanth, 1 part.
Gum arabic, 2 parts.
Cinnamon-water, 12 parts.

Reduce the whole of the solid matters to powder, and knead this with the cinnamon-water into a soft and ductile mass; divide this mass into small portions, and give to the latter a conical shape with tripod basis. Dry the pastils first in the open air, and finally in the stove.

"Mr. E. Hollier, Dudley."—We expect to receive shortly an accurate description of the apparatus, accompanied by illustrative engravings.

"E."—It depends upon the nature of the claims. Send us a specification, and furnish us with all the details of the case.

"Mr. J. Brough, Manchester."—The subject upon which our correspondent addresses us is not within our province. We advise Mr. Brough to consult Sir James Clark, or some other eminent physician, and, above all, to eschew all quackery.

"J., Sheffield."—*Iris-green* is prepared by grinding the juice of the blue flag with quicklime. Sap-green is prepared from the juice of buckthorn berries. The berries are allowed to ferment for a week or eight days in a wooden tub. The juice is then pressed out, and strained. A little alum is added to the fluid, and the latter is subsequently evaporated to a proper consistence. It is then run into pigs' bladders, which are suspended in a dry place to allow the pigment to harden. An inferior article is made from the juice of black alder and of evergreen privet. It is a common practice to add ¾ pint of lime-water and ¼ ounce of gum arabic to every pint of either of the above juices.

"Mr. W. Smith, Kennington."—Take of best ivory-black, reduced to a very fine powder, 1 pound; treacle, 1 pound; sweet olive oil and oil of vitriol, of each ¼ pound. Mix the ivory black, the treacle, and the olive oil together, and stir the mixture (or, better still, rub it on a marble slab) until the olive oil is perfectly "killed." Add now gradually the vitriol, diluted previously with three times its weight of water. Mix thoroughly, and let the mixture stand for three hours. Bring it to the proper consistence with sour beer.

"A Chemist."—Ward's white drops are prepared as follows:—Dissolve four ounces of quicksilver in one pound of nitric acid; add to the solution seven ounces of carbonate of ammonia; evaporate and crystallize. Dissolve the crystals in four times their weight of rose-water. These drops are poisonous, of course.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—June 2, 1849.

ORIGINAL SERIES.

ON THE MANUFACTURE OF SUGAR.

By J. SCOFFERN, M.B., Lond.,
Late Lecturer on Chemistry at the Aldersgate College of Medicine, London.

[*Concluded from page* 324.]

THE OPERATION OF REFINING—(*concluded*).

The Operation of Vacuum Boiling.—As a full description of the vacuum-pan, and of the general process of vacuum boiling, have been given already, at page 85, it only remains here to be remarked that, whether in the colonies or in refineries, the operation and the end to be achieved by it are the same.

The reader will, therefore, assume that the liquor, having come from the charcoal-tanks, has been subjected to the process of boiling, and has subsequently been allowed to remain in the heater for the necessary period (say half an hour for good solutions), to admit of the grain becoming sufficiently developed.

The manufacturer proceeds now to the operation of filling the moulds or cones.

These moulds for loaves or crushed lump, and occasionally pieces, are either made of sheet iron, painted white internally, or of copper. The larger moulds, however, employed for accomplishing the drainage of bastards are generally made of rough clay ware.

For every kind of mould copper is the best material; but the great expense of using it is a drawback to its general use—to such an extent, indeed, that very few of even the more wealthy sugar-refiners employ this metal, for any mould above the size necessary to contain a fourteen-pound loaf.

Previously to the commencement of the operation of filling, the moulds, standing in triple or quadruple row, the hole in the apex of each accurately plugged with a pledget of brown paper, technically called "a stop," are placed base upwards around the fill-house in such a manner that the rearmost row is supported by the wall, and each successive row by the one behind. Thus arranged, the greatest portion of the area of the fill-house is clear, enabling the operator or operators to fill any mould at pleasure.

The art of filling is very simple; one man dips, by means of a copper ladle, a portion of the crystallized mass, which he pours into the fill-basin, an instrument something like a copper coal-scuttle, with two small handles. This fill-basin, when charged with its contents, is carried underhanded, and somewhat between the legs of the fill-house man, to its destination, *i.e.*, the moulds, which are then filled to the brim.

If the moulds were now left merely filled, their contents would aggregate irregularly, and a good loaf would not result. Some little time after the operation of filling, therefore, the process of hauling, as it is technically called, is had recourse to. This process consists in agitating or incorporating, by means of a wooden spatula, some two or three inches in depth of the filled mass. Care, however, is taken not to push the hauling spatula too deep into the contents.

The process of hauling having been gone through, the cones are allowed to remain in the fill-house for a period varying with the size of the loaves, and hence of the mass to be cooled. Supposing fourteen-pound loaves to be the size, a period of twelve hours is amply sufficient.

The filled moulds are now put into a basket, let down through the *pull-up hole*, and elevated to the second floor,* called the liquor-loft, where the important operations, first of natural drainage, subsequently of artificial drainage (effected by claying and liquoring), are achieved. Formerly real clay was employed, but now we use instead a mixture (*not* a solution) of sugar and water, to which the term clay is applied.

* The ground floor being considered the first.

As soon as the filled moulds arrive in the liquor-loft, each is placed over a glazed earthen pot, the paper stops having been previously removed; and a bradawl is pushed up into the mass to the extent of two or three inches. Drainage now proceeds with a degree of rapidity corresponding to the amount of concentration to which the mass had been brought by evaporation, and also dependent in a great measure on the more or less complete absence of glucose and other impurities. If the evaporative concentration has not been carried very far the result is said to be low or free boiled—if the contrary, the designation high or stiff boiled is used.

As heavy compact loaves are a great desideratum to refiners, owing to the great cohesion of such loaves enabling them to withstand, without much injury, the agencies of damp air, and the various mechanical shocks to which they are subsequently liable to be exposed, it is a main object in the refinery operation to carry the evaporative agency to the maximum extent, consistent, of course, always with free subsequent drainage, since, if carried beyond certain limits, the loaves either will not drain at all, or their syrup runs away with such difficulty that a great monetary loss is incurred. In refineries the object of boiling *stiff* is intelligible enough, and founded on a scientific principle. In the colonies the object, although intelligible, is most fallacious, and in direct contravention to all scientific indications. The colonial sugar-grower, who argues the existence of a refinery precedent for stiff boiling, forgets this most important difference, that, whilst the refiner boils as stiff as is consistent with free drainage, he, the colonist, boils stiff, with perfect disregard of this important consideration.

When the first or natural syrup of drainage has ceased to flow each mould is removed, and a few inches (equal to the depth disturbed by the operation of hauling) of the mass removed by a revolving blade, with a central axis connected to a flywheel, and worked by a grindstone handle. This instrument is termed the *facing*-machine, and the chilled and badly crystallized sugar thus removed falls into a box.

The contents of the moulds after natural drainage are said to be in the green, and the portions removed are termed green cuttings.

The moulds, with their contents, are now set again upon pots (the same or others at the operator's pleasure), and preparations for the claying operation are made. The green cuttings being put into a pan are kneaded with water, at first into a doughy consistence; subsequently more water is added until the mixture is reduced to the condition of a thinish magma, termed clay.

Upon the base of each cone, again placed on the syrup-pots, is now poured so much of this clay as is sufficient to about half replace the amount of material cut away by the operation of facing.

In order to understand the precise rationale of the process of claying, it is necessary to bear in mind that the claying agent consists of a saturated aqueous solution of almost pure sugar, which solution holds in mechanical suspension a larger portion of undissolved sugar. No sooner does the clay agent touch the surface of sugar in the mould than a downward current of sugar solution is established, carrying before it a portion of coloured syrup, and causing the base of the sugar cone, to the extent of some inches, to assume a white appearance.

One operation of claying, however, is insufficient to effect a perfect whiteness throughout the loaf, and a repetition of the operation is not so effective as the process of liquoring, which is now in refineries universally followed. The liquor used for this operation is a saturated solution of pure sugar and water. It is prepared by dissolving in pure water a porous kind of lump sugar—such as results from the latter working of the refine on the fourth day—in a blow-up pan (which is used exclusively for this purpose), and filtering the solution through a charcoal cistern in the ordinary way, but with much care. The filtrate should be colourless, and should possess a density of at least 32° Beau., at a temperature of 70° Fahr. Owing to its possessing this high density, magma liquor is not prone to ferment; it may, therefore, be kept in tanks for a considerable time without danger. These liquor-tanks, however, should be situated in a cool part of the building; the best position for them is under the roof in a loft to which the external air has free access.

The operation of liquoring is commonly performed by means of a garden water-pot, without the rose, and consists simply in pouring upon the base of each conical lump of sugar, yet in the mould, as much as the mould will contain, an even surface having been previously made by an instrument termed the bottoming-trowel.

The operation of liquoring is precisely like that of claying, and effects the total separation by drainage of all chemical colouring matter. Fourteen-pound loaves, if made of well-purified sugar, should be rendered neat or white by two successive liquorings.

It is almost too obvious a matter for comment, or indication, that the last syrups of drainage, technically called drips, resulting from the operation of liquoring, are much purer, or, in other words, contain much more sugar, than the natural syrup of drainage, and that resulting from the operation of claying. Accordingly the drips are collected, and put into a separate tank, to be hereafter boiled up with a fresh working of sugar.

It may be easily ascertained whether a loaf requires more liquoring or not, by lifting it from the pot, and noticing the colour of the syrup which leaks away. This observation, it is scarcely necessary to remark, should be made when the drainage has almost ceased. If the drops are limpid, the operation has been complete, and the loaves are said to be neat; if they are coloured, another liquoring is indicated.

The loaves are now allowed to remain for two or three days, when the clay is cut or scraped away from their surface by a kind of triangular blade. This operation is called brushing off; the loaves are then slightly loosened in their moulds by striking the edges of the latter smartly against the upper end of a vertical post. This loosening contributes to perfect the drainage.

At the stage of loosening, a loaf may be completely removed from its mould, for the purpose of effecting an examination; which examination, in point of fact, is frequently made. When the loaves have become sufficiently dry to permit of being handled, they are taken out of the moulds, and their apices or noses are trimmed into regular form by means of the nosing-machine, an instrument consisting of three cutting blades, so arranged on a rotatory shaft that the desired angle for the apices shall result. Not only is this operation of nosing desirable, for the purpose of imparting a sharp well-defined apex to the loaf, but also for removing a small amount of dark-coloured sugar, of which the apex is under the most favourable circumstances composed. The efficacy of the claying and liquoring operations depends on the preponderance of gravity over capillary attraction. Hence there may be conceived a theoretical limit at which the two forces are balanced: practically this point of equalization between the two forces is at a few inches above the apex of the cone, and corresponds with the limit of impure sugar.

Occasionally, when liquors have been over-boiled, or when the material operated upon has been impure sugar, the point of equalization between the two forces is many inches above the normal line. To expedite the drainage of such cones, they are stuck into a kind of funnel, the neck of which joins a suction-pipe in communication with the air-pump of the vacuum-pan. The result of this treatment is too obvious for comment.

The operation of nosing is never performed on the larger kind of loaves, which are known in commerce under the denomination of lumps;

but the coloured portion of the apex is simply cut off by means of a knife struck by a mallet.

The loaves, if sufficiently dry, are now wrapped in paper, and the last traces of moisture driven off by the operation of stoving.

The stove is a chamber, or rather a hollow tower, provided with many rows of trellis-work, and heated by steam-pipes, to a temperature not above 115° Fahr. If heated to a higher degree the sugar is discoloured. The operation of stoving lasts about three days, when the loaves being taken out are ready for sale.

If, instead of loaves, the manufacturer desired to obtain the material known as crushed lump, the contents of the moulds would never be stoved at all; but when sufficiently dry they would be taken out, and struck with a mallet, until reduced to a mass of disaggregated crystals. At least this is the plan followed in making the better kind of crushed lump. In Scotland, however, where crushed lump is employed more largely than in England, and where the maximum of whiteness is no object, the processes of claying and liquoring are omitted, the natural drainage of the sugar being sufficient to effect the desired result. I am informed, however, by a Scotch refiner, that for this operation the very best sugar must be used, and must be boiled very low or free.

Much of the economy of refining depends on the proper employment of the syrups of drainage, and on this point the following axiom should never be lost sight of:—That every syrup of drainage is more impure for equal specific gravities of aqueous solution than the sugar from which it has drained.

This axiom will indicate the following rule to be adopted in the treatment of syrups, namely, to add the purest syrup to the purest sugar, and *vice versâ*.

In proportion as sugar solutions are more frequently reboiled, so do their impurities continue to increase, until at length the impurities, when washed out, leave the crystals of sugar so far asunder that the mass, instead of being hard and compact, is so porous that pressure with the end of a stick leaves an indentation; such masses could not be stoved for loaves, neither could they be profitably broken down for crushed lump, inasmuch as the crystals are small and ill-developed, in consequence of being admixed with so many impurities that the operation of crystallization has been impeded.

Chemically speaking, however, they consist, or by adequate liquoring can be made to consist, of sugar as pure as the hardest loaves; they, therefore, serve for making the magma liquor as already described.

When the impurities have so accumulated in syrups that it is no longer profitable to obtain the white sugar out of them by the process of claying and liquoring, a compromise is effected of the following kind:—They are no longer liquored with magma liquor, which would not be remunerative, but with syrup; and the result is called pieces. This is the real Jamaica sugar of many grocers.

When the material to be boiled is not sufficiently good to yield a light yellow product, dark, clammy, semi-crystallized masses are obtained, technically known as bastards. It cannot be too emphatically expressed, however, that the terms "pieces" and "bastards" are purely conventional; that no intrinsic or essential difference whatsoever exists between them; that both are admixtures of sugar, plus impurities; that such impurities *may* be separated, although it be not remunerative to do so.

Indeed, the mere demonstration may be easily effected by rubbing the pieces, or bastards, with alcohol, and filtering through paper. Cold alcohol does not dissolve sugar; but it readily dissolves the glucose and dark acids with which it is contaminated, and leaves the sugar nearly pure. The latter, if dissolved in water, and carefully evaporated, leaves a result not distinguishable from that arising from any other pure sugar solution.

Bastards being the most impure kind of refinery crystallized produce, the reader will have anticipated the remark, that the syrup of drainage from bastards is treacle.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LIX.

(LECTURE LXXXVII.)

VEGETO-ALKALIS—(*Continued*).

QUININE AND CINCHONINE—(*Continued*).

CRUDE QUININE.

Treat the bark with hydrochloric acid, lime, and alcohol in the same way as you would do if you intended to prepare sulphate of quinine; but, instead of acidulating the alcoholic liquor, distil it off at once. The residuary product consists of a plastic mass of firm consistence; this mass is a mixture of quinine, cinchonine, fatty matter, and colouring matters. It is technically termed "crude quinine." It has been used successfully as a febrifuge by Dr. Trousseau; it does not purge, like sulphate of quinine, and proves efficacious in smaller doses than the latter preparation. It has, moreover, this great advantage over the sulphate, that it is not very perceptibly bitter, which makes patients, particularly children, take it with less reluctance than they would the intensely bitter sulphate.

One kilogramme of good Calisaya bark yields about 32 grammes of crude quinine.

HYDROCHLORATE OF QUININE.

This salt crystallizes in nacreous needles; it is more readily soluble than the sulphate. It contains 1 equivalent of quinine, 1 equivalent of acid, and 3 equivalents (=6.79 per cent.) of crystallization water.

It is prepared as follows:—

Dissolve 100 parts of sulphate of quinine in about 300 to 400 parts of boiling distilled water. Add to the solution 30 grammes of crystallized chloride of barium. Filter off the sulphate of baryta which forms, and evaporate the filtrate until some crystalline points make their appearance on the surface of the liquid. Place the liquid now in a cool spot, and let it crystallize.

Hydrochlorate of quinine prepared by the direct action of the acid has always a greenish tint; it is important to make quite sure that there remains no chloride of barium in the liquor; the presence of this salt may be readily ascertained by testing with sulphuric acid, or with a sulphate.

The nitrate of quinine is prepared in the same way as the hydrochlorate, substituting simply nitrate of baryta for the chloride of barium.

ACETATE OF QUININE.

The acetate of quinine crystallizes with the greatest facility in the form of silky, nacreous needles.

This salt is prepared by the following process:—

Reduce the quinine to powder; mix the powder with water, heat the mixture, and add a sufficient quantity of acetic acid to effect the solution of the quinine, and to leave the liquid only feebly acid. Filter boiling, and let the salt crystallize from the filtrate.

Acetate of quinine is composed of one equivalent of quinine, one of acetic acid, and one of water.

TARTRATE AND CITRATE OF QUININE.

These two salts are almost insoluble.

They are prepared from sulphate of quinine by double decomposition with citrate or tartrate of soda.

FERROCYANATE OF QUININE.

The ferrocyanate of quinine is a yellow, bitter salt; it crystallizes in small acicular masses. It is insoluble, or almost so, in water, but dissolves very readily in alcohol. It is efflorescent in the air.

It is composed of one equivalent of protocyanide of iron, two equivalents of hydrocyanate of quinine, and one of water.

It is used as a febrifuge. In the treatment of intermittent fevers, attended with inflammatory symptoms, it is preferred to the sulphate.

The ferrocyanate of quinine is prepared in the following manner:—

Take of Sulphate of quinine, 3 parts.
Ferrocyanate of potass, 1 part.

Mix the sulphate of quinine with a sufficient quantity of water to form a very thin pap. Pour this into a physic bottle, and add to it the ferrocyanate of potass dissolved in a small quantity of water. Heat the mixture to boiling, keep it boiling for a few minutes, and then let it cool. A resinous mass separates, which becomes dry upon cooling: this is the ferrocyanate of quinine. Upon concentration of the liquor filtered off from this mass a fresh quantity of it separates. Purify the whole of the product by washing with hot water. Dry the washed salt, and reduce it subsequently to powder. This process (with some trifling modification) is Professor Bertozzi's, of Cremona. It is preferable to all other processes that have hitherto been proposed.

To obtain the salt in the crystalline state, you need simply dissolve it in alcohol, and leave the solution to spontaneous evaporation: you will obtain two products, viz., crystallized ferrocyanate of quinine, and a resinous mass. Redissolve the latter in alcohol, and leave the solution to crystallize. You will again obtain the same two products as in the first operation. By repeating the same process a great many times you will in the end succeed to convert the whole of the amorphous resinous mass into crystals.

VALERIANATE OF QUININE.

This salt has been studied by the Prince of Canino. It is composed of one equivalent of quinine, one equivalent of acid, and two equivalents of water.

It crystallizes in octahedrons, or in hexagonal prisms, frequently forming silky masses. It has a bitter taste, and smells feebly of valerianic acid. It is soluble in water and in alcohol. At 194° Fahrenheit it loses an equivalent of water, and fuses into a resinous mass insoluble in water. Protracted contact with boiling water effects the same decomposition.

The process of preparing valerianate of quinine is as follows:—

Add to a concentrated alcoholic solution of quinine valerianic acid slightly in excess. Add subsequently to the solution double its own volume of water, and leave the liquid to spontaneous evaporation, in a stove heated to about (but not beyond) 122° Fahrenheit.

Valerianate of quinine, in very small doses, is an excellent antiperiodic, and is considered by many eminent practitioners superior to the sulphate, inasmuch as it appears less irritating and more energetic in its action against neuralgic affections and pernicious fevers. It is administered in form of pills, or in potion, at the dose of from 5 to 30 or 40 centigrammes.

COMPARATIVE TABLE OF THE RESPECTIVE MEDICINAL VALUES OF QUININE AND ITS SALTS.

One part of crystallized quinine is equivalent to

1.15	of the crystallized		sulphate.
1.01	"	"	acetate.
1.01	"	"	citrate.
1.05	"	"	tartrate.
0.95	"	"	hydrochlorate.
1.01	"	"	ferrocyanate.

One part of crystallized sulphate of quinine is equivalent to

0.87	of the crystallized		quinine.
0.85	"	"	acetate.
0.90	"	"	citrate.
0.91	"	"	tartrate.
0.82	"	"	hydrochlorate.
0.87	"	"	ferrocyanate.

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, Mortimer-terrace, Notting-hill, Kensington.

[*Continued from page* 391.]

Table III.

TABLE OF THE MORE IMPORTANT BINARY COMPOUNDS OF THE METALLOIDS OR NON-METALLIC ELEMENTS, WITH THEIR NAMES, FORMULÆ, ATOMIC WEIGHTS ON THE HYDROGEN AND OXYGEN SCALES, AND THEIR PER-CENTAGE COMPOSITION.

	Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
1.	Boron	B	10.91	136.20	
	Boracic acid	BO^3	34.95	436.20=B	31.22—O 68.78
	Terchloride	BCl^3	117.32	1464.16=B	9.30—Cl 90.70
	Terfluoride	BF^3	67.13	837.60=B	16.26—F 83.74
2.	Bromine	Br	78.39	978.31	
	Bromic acid	BrO^5	118.46	1478.31=Br	66.38—O 33.62
	Perchloride	$BrCl^5$	255.74	3191.56=Br	30.65—Cl 69.35
3.	Carbon	C	6.13	76.44	
	Carbonic oxide	CO	14.14	176.44=C	43.32—O 56.68
	Carbonic acid	CO^2	22.15	276.44=C	27.65—O 72.35
	Oxalic acid	C^2O^3	36.29	452.87=C	33.76—O 66.24
	Dichloride	C^2Cl	47.72	595.53=C	25.67—Cl 74.33
	Protochloride	CCl	41.60	519.09=C	14.73—Cl 85.27
	Perchloride	C^2Cl^3	118.66	1480.83=C	10.32—Cl 89.68
	Bisulphuret (sulpho-carbonic acid)	CS^2	38.36	578.77=C	15.97—S 84.03
4.	Chlorine	Cl	35.47	442.65	
	Oxide (hypochlorous acid)	ClO	43.48	542.65=Cl	81.57—O 18.43
	Chlorous acid	ClO^3	59.50	742.65=Cl	59.60—O 40.40
	Chloric acid	ClO^5	75.53	942.65=Cl	46.96—O 53.04
	Perchloric	ClO^7	91.56	1142.65=Cl	318.74—O 61.26
5.	Fluorine	F	18.74	233.80	not known to be electro-positive to any other element.
6.	Hydrogen	H	1.00	12.47	
	Oxide (water)	HO	9.01	112.47=H	11.09—O 88.91
	Peroxide	HO^2	17.03	212.47=H	5.87—O 94.13
	Bromide (hydrobromic acid)	HBr	79.39	990.79=H	1.26—B 98.74
	Dicarburet (light carburetted hgn.)	H^2C	8.13	101.40=H	24.83—C 75.17
	Olefiant gas	HC	7.13	88.92=H	14.04—C 85.96
	Chloride (hydrochloric acid)	HCl	36.47	455.13=H	2.74—Cl 97.26
	Fluoride (hydrofluoric acid)	HF	19.73	246.28=H	5.07—F 94.93
	Iodide (hydriodic acid)	HI	127.57	1591.98=H	0.78—I 99.22
	Sulphuret (hydrosulphuric acid)	HS	17.12	213.65=H	5.84—S 94.16
	Persulphuret	HS^5? or HS^2?			
	Seleniuret of hydrogen	HSe	40.63	507.06=H	2.46—Se 97.54
	Phosphoretted hydrogen (gas)	H^3P^2	34.44	429.82=H	8.71—P 91.29
7.	Iodine	I	126.57	1579.50	
	Iodic acid	IO^5	166.63	2079.50=I	75.96—O 24.04
	Periodic acid	IO^7	182.65	2279.50=I	69.31—O 30.69
	Bromide	IBr^5	518.53	6471.03=I	24.41—Br 75.59
	Perchloride	ICl^5	303.92	3792.76=I	41.64—Cl 58.36
8.	Nitrogen	N	14.19	177.04	
	Protoxide	NO	22.20	277.04=N	63.90—O 36.10
	Binoxide	NO^2	30.21	377.04=N	46.95—O 53.05
	Hyponitrous acid	NO^3	38.22	477.04=N	37.11—O 62.89
	Nitrous acid	NO^4	46.23	577.04=N	30.33—O 69.67
	Nitric acid	NO^5	54.24	677.04=N	26.15—O 73.85
	Chloride (Berzelius)	NCl^3	120.60	1504.99=N	11.76—Cl 88.24
	Iodide	NI^3	393.89	4915.53=N	3.60—I 96.40
	Ammonia	NH^3	17.19	214.47=N	82.54—H 17.46
	Cyanogen	NC^2 or Cy	26.45	329.91=N	53.66—C 46.34
9.	Oxygen	O	8.013	100.00	
10.	Phosphorus	P	15.72	196.14	
	Phosphorus acid	P^2O^3	55.47	692.28=P	56.67—O 43.33
	Phosphoric acid (anhydrous)	P^2O^5	71.50	892.28=P	43.96—O 56.04
	Sesquichloride	P^2Cl^3	137.84	1720.24=P	22.80—Cl 77.20
	Perchloride	P^2Cl^5	208.78	2605.54=P	15.06—Cl 84.94
	Sesquiiodide	P^2I^3	411.03	5130.78=P	7.65—I 92.35
	Periodide	P^2I^5	664.27	8289.78=P	4.73—I 95.27
11.	Selenium	Se	39.63	494.58	
	Selenious acid	SeO^2	55.66	694.58=Se	71.21—O 28.79
	Selenie acid	SeO^3	63.67	794.58=Se	62.24—O 37.76
12.	Sulphur	S	16.12	201.17	
	Sulphurous acid	SO^2	32.15	401.17=S	50.15—O 49.85
	Sulphuric acid	SO^3	40.16	501.17=S	40.14—O 59.86
	Hyposulphurous acid	S^2O^2	48.26	602.33=S	66.80—O 33.20
	Hyposulphuric acid	S^2O^5	72.30	903.33=S	44.59—O 55.41
	Chlorides	SCl? or S^2Cl?			
	Iodide	SI?			
13.	Silicon	Si	22.22	277.31	
	Silicic acid	SiO^3	46.26	577.31=Si	48.04—O 51.96
	Bromide	$SiBr^3$	257.40	3212.23=Si	8.63—Br 91.37
	Chloride	$SiCl^3$	128.63	1605.27=Si	17.28—Cl 82.72
	Fluoride	SiF^3	78.43	978.71=Si	28.33—F 71.67

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON SOME METEOROLOGICAL PHENOMENA.

By Prof. E. WARTMANN.

On a Mirage with a Strong Bise.—Most of the mirages described by authors appear to be manifested in a tranquil state of the air. M. Kämtz even affirms that a calm atmosphere is indispensable to their production.* Although this may be the ordinary circumstance, it is not always the case. More than once vessels have been carried along by the wind, and their images shifted in a similar manner. This phenomenon is often remarked on the Black Sea, from Odessa. The accounts of the observations of Woltmann near Cuxhaven,† and of Vince at Ramsgate,‡ leave no doubt with respect to this fact. The following is a similar instance, observed at Nyon in the summer of 1848 by M. Thury, formerly professor at Lausanne, and which is still better characterized than the previous ones.

It was twenty minutes to eight o'clock a.m. The bise had raised foaming waves upon the lake. In the south-east some vapours floated on the horizon: the sky in every other part was of a clear blue. By the aid of a good telescope of 0.068 millim. aperture, and which magnified thirty times, M. Thury descried on the heights of Coppet, in the direction of Geneva, the two lateen sails of a bark the hull of which was not at all visible. A little below the lower extremity of these sails the commencement of their image was seen inverted. This incomplete image terminated abruptly on the agitated and clear surface of the water. The space which separated the sails from their image was of a uniform greenish-blue colour. The lowest strata of air undulated in a very perceptible manner.

This last circumstance, and the situation of the image below the object which it represented, are proofs that the phenomenon resulted from a greater heating of the atmosphere in the lower strata than in the more elevated regions. But for the hull of the vessel to be invisible, and for the contours of the objects, examined with a telescope at fourteen metres above the level of the water, to be perfectly well defined, the warmest zone of air must have terminated under the wind toward the base of the sails, that is to say, at three or four metres above the surface of the lake. The existence of a zone thus limited is therefore possible with the bise blowing sufficiently strong during the few minutes necessary for the observation. This fact recalls the persistence of the undulation in the strata of air which are close to the roofs and the ground during the warm hours of a summer's day, or above the chimneys in winter, notwithstanding the agitation produced by intense winds.

II. *On Blue Rays.*—On the 30th of November last, a little before sunrise, M. Thury perceived at Nyon, above the mountains which border the lake on the east, horizontal strata of light clouds tinged with a beautiful yellow. The sky, seen in the spaces between them, was of a deep azure colour. Toward the point of the horizon where the sun was about to appear, a dark blue ray rose divergingly up to a great height, and occupied a space in which no cloud was perceptible. This appearance vanished after two or three minutes.

Dr. Gosse has found among his father's papers the account of an analogous observation made at Lyons toward the end of the last century by this venerable founder of the Helvetic Society of Natural Sciences. The manuscript unfortunately has not been preserved.

What has been called a ray appears to me, on

* "Lehrbuch der Meteorologie," vol. iii., p. 87.—"Cours. Complet de Météorologie," translated by Ch. Martins, p. 422.

† Gilbert's "Annalen der Physik," vol. iii., p. 397.

‡ "Philosophical Transactions," 1799, p. 13.

the contrary, to be a phenomenon of shadow. The light of the sun, arrested by some obstacle out of sight, left the transparent vapours situated near the horizon invisible in a determinate region of the sky, whilst to the right and left it tinged them by playing upon them. The space not illumined should offer to the eye a blue colour, the more remarkable as it contrasted strongly with those of the adjacent strata of a golden-yellow. The diverging form of the ray is a well-known illusion in perspective. What apparently increased the separation of its margins towards the upper part was the less quantity of vapour existing in elevated regions.

It is to be regretted that M. Thury was not able to measure the height of the ray; this would have aided in determining the position and perhaps the nature of the screen (*écran*) which produced it. If this was one of the principal summits of the Savoy Alps, the appearance should recur periodically towards the 30th of November and the 13th of January, when the atmospheric conditions are favourable. Observers placed in proper localities would easily decide the truth of this supposition.

III. *On Solitary Crepuscular Rays.*—In 1846* I described a meteor of a character quite different from that of the blue rays, and which consisted of a single, vertical, luminous band, 35° high, without any trace of divergence. I afterwards found that Professor Christie had twice seen a phenomenon nearly analogous to this in 1834.† The rays examined by Mr. Christie were less extended than the band seen at Lausanne and Geneva. Moreover, they had a perceptible divergence, whilst the edges of the latter were absolutely parallel. Lastly, on the 31st of May, 1846, there was such a bise blowing that the sky was perfectly clear. The meteorological registers of Saint Bernard, Lausanne, and Geneva prove this. It, therefore, does not seem that these various appearances can be entirely assimilated. The theory proposed by the English savant must be subjected to new observations, as he himself admits. It will be useful to make with the polariscope some researches on the state of the light of the solitary rays, and of that of the atmosphere in the adjacent parts.—*Extracted from the Bibliothèque Universelle de Genève.*

OBSERVATIONS ON THE DETECTION OF ARSENIC IN CASES OF POISONING.

By Prof. WÖHLER.

To extract the arsenic and obtain it in the state of a liquid susceptible of filtration, the organic mass, as is well known, is changed or destroyed, according to its nature, by passing into it for a considerable time washed chlorine gas, disengaged by distilled sulphuric acid which has been tested; or by solution in concentrated caustic potash, saturation with muriatic acid, and subsequent treatment with chlorine gas; or by solution in nitric acid which has been previously examined; or lastly, by solution in muriatic acid and the addition of chlorate of potash. The muriatic acid must likewise have been prepared with distilled sulphuric acid free from arsenic; as on the employment of crude oil of vitriol it almost always contains arsenic, as is frequently the case with that derived from chemical works. It is equally necessary to examine the chlorate of potash, for at present that which occurs in commerce frequently contains lead. The use of chlorine, either immediately or after previous solution of the mass in the smallest requisite quantity of caustic potash, undoubtedly deserves the preference in most cases.

After the excess of chlorine has been removed from the perfectly saturated mixture by long-continued digestion at a gentle heat, the liquid is filtered, saturated with a current of washed sulphuretted hydrogen, which should be passed into it for a day, then stoppered, and set aside for at least twenty-four hours.

In order to reduce the arsenic to arsenious acid, and facilitate its precipitation by sulphuretted hydrogen, the liquid may, it is true, be saturated or mixed with sulphurous acid, digested for a time, and the sulphurous acid then expelled by boiling. However, not much time is saved by this, as the sulphurous acid does not act instantaneously but very gradually. It is perhaps more advantageous to heat the liquid freed from chlorine to about 158° F., and to saturate it at this temperature with sulphuretted hydrogen gas; as the arsenic acid is converted into sulphuret of arsenic, and precipitated quite as rapidly as the arsenious acid at the ordinary temperature.

The precipitate thus formed is allowed to subside, the excess of gas expelled by digestion at a gentle heat in an open vessel, the liquid decanted, the precipitate collected upon a small filter of Swedish paper and carefully washed. The decanted and filtered liquid is again saturated with sulphuretted hydrogen, in order to make sure. This precipitate always contains, besides the sulphuret of arsenic, some organic sulphurous matter, which cannot be destroyed by nitric acid alone, but which it is absolutely necessary to destroy, because it might operate injuriously, and give rise to error in the subsequent use of Marsh's apparatus, which in other respects is so sure and convenient.

This destruction of the organic matter is most readily and safely effected in the following manner:—

The filter with the precipitate is placed in a sufficiently capacious crucible of real porcelain, concentrated nitric acid poured over it, and then digested until the whole is dissolved and forms a homogeneous mass. The free nitric acid contained in it is saturated by the gradual addition of pure carbonate of soda, and the mass cautiously evaporated to dryness. Everything now depends on the circumstance of its containing the requisite excess of nitrate of soda, which is readily effected by adding a sufficient quantity of nitric acid at first. The crucible is now heated over an argand lamp gradually until the nitrate of soda fuses. At first the mass turns brown, then black, and melts quietly, without any deflagration, to a perfectly colourless transparent liquid. Every trace of organic matter is now perfectly destroyed, and the whole of the arsenic converted into arseniate of soda.

Concentrated pure sulphuric acid is now gradually dropped upon the cold hard saline mass in the crucible, and finally warmed with it, until, after the addition of excess of acid, the whole of the nitric and nitrous acids have been completely expelled, and the mass is converted into bisulphate of soda. If nitric acid containing muriatic acid had been used for oxidizing the precipitate by sulphuretted hydrogen, volatile chloride of arsenic might be formed, and occasion a loss of arsenic. It is, therefore, requisite in this respect to ascertain the purity of the nitric acid and of the carbonate of soda.

The acid saline mass is now dissolved in the crucible in the smallest possible amount of hot water, and this solution then gradually poured, by means of a funneled tube, in the usual way into Marsh's apparatus, which has been previously exhausted of air and filled with hydrogen gas.

It should be observed that, to hasten the production of arseniuretted hydrogen, the arseniferous liquid must contain no nitric acid; that this, therefore, must be completely expelled from the saline mass by the treatment with sulphuric acid.

To saturate the mass oxidized by means of nitric acid, carbonate of potash might be equally well employed; but soda was purposely directed, in case it were wished to seek for antimony in the poisonous mass. This would, then, be contained in the fused mass in the state of antimoniate of soda. The mass should then be dissolved in water previous to treatment with sulphuric acid, and the insoluble antimoniate of soda collected upon a filter.

If the poisoned mass had contained copper this would separate, on fusing the nitrate, as black oxide, and so betray its presence.

Whether the mirror formed in the glass tube by means of Marsh's apparatus consist of arsenic or of antimony is very readily determined, leaving out of question the difference of lustre, appearance, and other known characteristic differences, from the circumstance that a mirror of antimony, when again heated in the current of hydrogen, is far more difficult to volatilize than arsenic; that it communicates not the least odour of garlic to the gas, and that it fuses previous to being volatilized. If it is examined with the lens, after the spot has been heated over the spirit-lamp to redness, it is distinctly seen that the metal is fused at the margin, and has partly formed distinct bright globules of antimony,—a peculiarity which is never seen with arsenic, because it does not fuse.

Nothing is now more easy than the detection of arsenic in an organic substance, even when this contains a mere imponderable trace; the great difficulty, and that which occasions anxiety and danger in such disagreeable tasks, is in the employment of reagents and apparatus to avoid the introduction of arsenic into the examination, and finding arsenic where in reality it did not originally exist.—*Liebig's Annalen*, March, 1849.

* "Archives des Sciences Phys. et Natur.," vol. ii., p. 166.

† Report of the Fourth Meeting of the British Association for the Advancement of Science. Transactions of the Sections, p. 566. London, 1835.

SPURIOUS CHEMICALS.*

We have repeatedly had occasion to direct the attention of the readers of this journal to the adulteration of drugs. It is now our duty to notice a system, which appears to have prevailed to a considerable extent, not of adulteration, but of the wholesale substitution of comparatively worthless compounds, for valuable and powerful medicinal agents. Within the last few years compounds of valerianic acid with oxide of iron, with oxide of zinc, and with quina, have been introduced into medical practice as efficacious remedies, especially in hysteria, and other affections of the nervous and uterine system, and in fevers. A good deal of attention has been devoted by practical chemists to the preparation of these valerianates, and several processes for making them have been published in this and other journals. The valerianates, however, have always, and necessarily, been expensive preparations, yet the use of them has been gradually extended in consequence of the testimony borne to their great efficacy. Increased demand led to competition in the supply, which has recently resulted in the adoption, by some manufacturers, of a system of substitutions that would have speedily brought a valuable set of remedies into disrepute, had not the fraudulent practice been detected.

Citrate and tartrate of iron, flavoured with a few drops of oil of valerian, has been extensively supplied for valerianate of iron; and acetate of zinc, flavoured in the same way, has been substituted for valerianate of zinc; and these spurious compounds have been sold at prices which, although defying competition on the part of the genuine valerianates, have, nevertheless, been twenty or thirty times greater than the commercial value of the substituted articles. For valerianate of quina the disulphate of that base, with a little oil of valerian to disguise it, has been in like manner substituted.

Thus compounds have been supplied for the three medicinal valerianates, which have not contained a particle of the most important of the constituents which should have been present, namely, the valerianic acid.

Such being the nature of the frauds which have been practised, we have no doubt, upon

* From the "Pharmaceutical Journal."

many of or readers, we proceed to point out the means of detecting them :—

1. The true valerianates have a sour, disagreeable, and very persistent, although not powerful, smell, which is essentially different from that of oil of valerian.	1. The spurious imitations, being flavoured with oil of valerian, smell strongly of that substance.
2. The true valerianate of iron is almost entirely soluble in water; and the valerianate of quina fuses into oily globules in boiling water, and dissolves with difficulty. They are both freely soluble in spirit.	2. The spurious valerianate of iron is perfectly soluable in water, especially when aided with a little heat ; it is insoluble in spirit. The spurious valerianate of quina is soluble in about thirty parts of boiling water, and, as the solution cools, it is deposited in acicular crystals, which have the bitter taste and other characters of disulphate of quina.
3. The true valerianates when mixed with a little diluted hydrochloric acid are decomposed, and the valerianic acid, being set free, rises like oil to the surface of the liquid. To get this character it is necessary to operate upon from five to ten grains of the specimen, and to avoid the use of too much of the diluted acid, as valerianic acid is soluble in about thirty parts of water. The liberated valerianic acid has the sour, disagreeable, and a very persistent smell which, to a slight extent, is perceived in its salts, but is readily distinguished from that of oil of valerian.	3. The spurious valerianates, when added to water, will generally yield a thin film of oil, which floats on the surface, and is easily detected as oil of valerian. On heating the liquid this oil is driven off, without otherwise decomposing the salt, and no further indication of valerian will afterwards be obtained. On treating them with diluted hydrochloric acid there is no valerianic acid set free.
4. The true valerianates, when mixed with a little proof spirit, and one fourth the volume of oil of vitriol is then carefully added, will yield valerianic ether, which is recognised by its agreeable fruity smell, somewhat resembling that of the pine-apple. This ether can hardly be distinguished in smell from butyric ether.	4. The spurious valerianates yield no valerianic ether ; but the spurious valerianate of zinc, when treated as above, yields acetic ether, which is easily detected.

The foregoing tests are sufficient to distinguish the true valerianates from the spurious substitutes above mentioned, but there is reason to believe that other substitutions have been practised, although not so extensively. We have met with a specimen of so-called valerianate of iron, which is evidently not what its name indicates, and yet it contains neither citrate, tartrate, nor acetate. It is in the form of a brown powder, insoluble in water and in spirit. It smells of valerianic acid, but, on being decomposed with hydrochloric or sulphuric acid, yields no appreciable quantity of the oily product. We have not had time to submit this specimen to a careful examination, but it is easily distinguished from the true valerianate of iron by its being insoluble in spirit, while the latter dissolves freely in this menstruum, even without the application of heat. This suspected specimen is also distinguished from the genuine by its behaviour when heated in a platinum crucible.

The true valerianate, if carefully heated, fuses, gives off valerianic acid undecomposed, then, as the heat is increased, burns with a luminous flame, and emits a very offensive odour.

The suspected specimen does not fuse or give off any appreciable quantity of valerianic acid. The vapour does not readily inflame, and the odour emitted is not offensive.

The residue of oxide of iron is the same in both specimens, namely, twenty-five per cent., and the acid originally present is organic.

Where mere adulteration is practised, the detection of the fraud is much more difficult than it is in the cases to which we have hitherto alluded, the cupidity of the manufacturer having fortunately, in these cases, blinded his discretion, so that a speedy exposure of the practice was inevitable.

About three years ago, as we find from the "Journal de Pharmacie," much of the valerianate of zinc met with in Paris was found to have been made with butyric acid, instead of valerianic acid. The butyrate thus substituted was of a more beautiful and crystalline appearance than the true valerianate, but it did not essentially differ in character, and the detection of the fraud, by satisfactory tests, was not easily accomplished. A paper was published on the subject by Messrs. Laroque and Huraut, in which they recommend the use of a concentrated solution of acetate of copper for distinguishing valerianic from butyric acid. In the use of this test, however, it is necessary, in the first place, to eliminate the acid by adding sulphuric acid to the salt and separating the volatile acid by distillation. When butyric acid is added to the concentrated solution of acetate of copper a bluish-white precipitate is immediately formed ; but, on adding valerianic acid in like manner, there is no immediate appearance of precipitation or turbidity of the liquid, but, on shaking it, oily drops of a greenish colour separate, partly rising to the surface and adhering to the sides of the vessel, and partly falling to the bottom. These oily globules consist of anhydrous valerianate of copper, which retains this condition sometimes for twenty minutes or more, but it ultimately becomes hydrated, and then forms a bluish-green crystalline powder.

The greatest possible vigilance and care are requisite on the part of those supplying compounds, such as we are here noticing, for medicinal use. Some of these compounds have been but little studied by chemists, and the means of distinguishing them by chemical tests is not always complete or satisfactory. If manufacturers are disposed to be dishonest, it is sometimes difficult to detect all their fraudulent practices ; and a single individual may thus entail discredit upon hundreds of unconscious dupes, who become the venders or dispensers of spurious or sophisticated articles. The injury thus inflicted on medical science is of a very serious nature, for what becomes of the value of medical experience with reference to the action of remedies, if no dependence can be placed upon their identity? A physician sees an account of the great benefits which have been derived from the administration of valerianate of zinc or iron in some very troublesome complaints. He prescribes the remedy, but after a lengthened trial finds it to be unavailing, and accordingly he discards it from his materia medica unless, perchance, as in the present instance, it is discovered that the remedy employed was entirely different from that prescribed, and then the dispenser and the wholesale vender are alike involved in the mortification and disgrace of having obstructed the efforts of science to relieve the sufferings of the afflicted. Is it not too often the case that the skill and learning of the physician are stultified by practices such as it has now been our painful duty to record and to reprobate?

It was but the other day that a case came within our knowledge in which a medical man, being desirous of trying the action of different anæsthetic agents, made a series of experiments with Dutch liquid. Having complained of the price charged for the first specimen which he obtained, further supplies were procured from a different source; but after devoting much time to the investigation of the medicinal action of the remedy, with the intention of publishing the results, what must have been his mortification to find that the substance he had used was not Dutch liquid at all, but appeared to be a mixture of chloroform and spirit? The physical characters of chloroform and Dutch liquid are so similar that they cannot be distinguished by taste, smell, or general appearance; and the addition of a little spirit to chloroform gives to the latter the property of burning, and reduces its specific gravity, so as to assimilate in these respects with Dutch liquid. The fraud was ultimately detected in the case alluded to by mixing some of the spurious article with water, when the spirit was separated, reducing the volume of the liquid to one half, and this was found to be no longer combustible.

The practice of medicine is either based upon principles which have been established by the careful observation of the action of remedial agents, or it is a system of quackery and deception. Yet it is obvious that all observations must be worse than worthless, and that no step can be taken in the advancement of the science of medicine as a remedial art, unless well-defined agents be employed, and their identity be constantly maintained. How great, then, is the responsibility of the dispenser of medicines! How greatly is the physician dependent upon his intelligence, integrity, and skill!—and how much does it behove the public to require that those who are engaged in the administration of medicine shall be competent for the performance of their responsible duties!

ON THE PRODUCTION OF ARTIFICIAL OIL OF RUE FROM COD-LIVER OIL.

By Dr. RUDOLPH WAGNER.

It is well known that cod-liver oil, when mixed with strong sulphuric acid, furnishes at first a purple-red tenacious mass, which colour almost immediately passes into a brownish-red, and then into a dark brown. If this mass is supersaturated with a caustic or carbonated alkali or an alkaline earth, and then heated, a penetrating odour of the essential oil of rue (Ruta graveolens) is disengaged. To procure the odoriferous substance in sufficient quantity for analysis I mixed pretty considerable quantities of cod-liver oil and sulphuric acid, then saturated with potash or lime, and distilled with water. The water which passed over was turbid, and possessed an excessively strong odour of rue ; but only in a few cases was I able to perceive any drops of oil upon its surface. Other experiments, in which I treated the fatty acids separated from the saponified cod-liver oil in a similar manner, furnished no better results. Fish oil and train oil, from train-oil soap, submitted to a similar treatment, furnished the same result.

I am not able to state more of the oil obtained than that it is of a light yellow colour, lighter than water, boils about 572°, and possesses the pure odour of the oil. With respect to the remarkable production of this oil from train oil by the action of sulphuric acid and subsequent saturation with a base, I may observe that it certainly exists as such in the train oil, and cannot be considered as a product of decomposition by sulphuric acid. I found amongst the volatile fatty acids of cod-liver oil butyric and capric acids. Now, if we bear in mind that Gerhardt has recently asserted that the oil of rue is the aldehyde of capric acid, $C^{20} H^{20} O^2$, which he rendered probable by converting it by treatment with nitric acid into a different acid of the formula $(C^2 H^2)\, n + 4O$, pelargonic acid, we may be allowed to conclude that the sulphuric acid enters into a combination with the aldehyde

of capric acid, or, rather, with the oxide of caprinyle, C^{20} H^{19} O, and that this compound is decomposed on the addition of a base, when the aldehyde separates. This aldehyde, on becoming rancid, that is, by the absorption of two equivalents of oxygen, forms capric acid, C^{20} H^{19} O^3 + HO. That the latter does not give rise to the production of the oil of rue is shown from the fact that the capric acid is not at all altered by mixture with sulphuric acid.

The characteristic odour of the oil of rue, or of the aldehyde of capric acid, furnishes us with the means of detecting the presence of capric acid, or, rather, of the aldehyde, which always accompanies it. For instance, when fresh butter is heated with concentrated sulphuric acid, and potash is added in excess to the melted brown-red mass, the odour of the oil of rue is distinctly perceptible amidst the penetrating odours of the volatile fatty acids contained in the butter. I obtained the same odour by submitting to a similar treatment various sorts of fish oil, a piece of herring, several kinds of cheese, &c.

I will mention, in conclusion, that a mixture of train oil and sulphuric acid, saturated with lime, having been kept several days before distillation, the distillate consisted of a turbid water, which no longer possessed the odour of oil of rue, but very distinctly that of peppermint. This circumstance is interesting, on account of the isomerism of the oil of rue with the camphor of the oil of peppermint.—*Journ. für. Prakt. Chem.*, xlvi., p. 155.

THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE ATMOSPHERE FROM 1845 TO 1848.

By FRANKLIN COXWORTHY, Esq.

[To the Editor of the Chemical Times.]

Sir,—The value to science of all facts relating to electricity being now fully appreciated, I beg to submit for insertion in your valuable journal the accompanying statement, showing the relative electrical condition of this portion of the atmosphere, and of the upper crust of the earth, from 1845 to the end of 1848, and of the rate of mortality in the metropolis for the same period.

Should you deem this statement worthy of a place in your journal, I purpose at a future period making a few observations in reference to its importance in regard to meteorology and agriculture. The differences in the evaporation are registered every morning at nine o'clock and at about ten o'clock at night.

I am, sir, your obedient servant,

FRANKLIN COXWORTHY,
Author of "Electrical Condition."

Westminster-road,
May 31, 1849.

STATEMENT.

Statement showing the relative electrical condition of the earth and the atmosphere during the years 1845, 1846, 1847, and 1848, as indicated by the evaporation of water from two copper vessels or scales, one insulated and the other not. The vessels are seven and a half inches diameter, containing each about thirty-two ounces of water, and are suspended under a lean-to roof, on the north side of a wall, where they are protected from the influence of wind, sun, and rain. They are fourteen feet from the ground, with which one of them is electrically connected by a stout copper wire. Also showing the mortality per cent. in the metropolis for the same period.

DATE.	1845.		1846.		1847.		1848.		REMARKS.
	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	
January	The vessels, or scales, were first filled on the 10th of October, 1845.	..	..	270	115	140	40	325	The rate of mortality is taken from a table published by the Registrar-General in 1849.
February		..	..	70	280	105	100	55	
March		..	365	33	370	130	145	170	
April		..	215	75	195	195	60	295	
May		..	310	345	225	185	240	275	
June		..	445	460	200	175	425	145	
July		..	900	100	215	225	335	175	
August		..	245	35	355	65	340	65	
September		..	225	120	345	65	105	180	
October			280	145	150	275	310	145	
November	960	..	130	195	90	290	140	95	
December			245	135	80	320	160	150	
Grains	960	..	3360	1983	2620	2170	2400	2075	
Mortality	2.379		2.379		2.782		2.662		per cent.

ON SALICYLIC ETHER, AND SOME PRODUCTS DERIVED FROM IT.

By A. CAHOURS.

In my investigation on the heavy oil of Gaultheria procumbens (salycilate of methylene), I showed that salicylic ether forms, like the latter, definite crystalline compounds with bases. If the combination of this substance with baryta is submitted to distillation after having been perfectly dried, it furnishes a residue of carbon and a limpid colourless volatile liquid, to which I have given the name of phenetole. On analysis it gave the following results:—

Carbon	78.48	16=96	78.68
Hydrogen	8.29	10 10	8.10
Oxygen	13.23	2 16	13.13

It is consequently homologous with anisole, C^{14} H^8 O^2, from which, in fact, it differs only in the addition of C^2 H^2.

I have admitted that anisole might be regarded as the phenate of methylene, founded upon the fact that binitroanisole and trinitroanisole are decomposed, by ebullition with an alcoholic solution of potash, into nitrophenesic and nitrophenisic acids. Phenetole may be viewed as the phenic ether of alcohol; in fact, we again meet with the same difference with respect to the boiling point of these two substances as between the corresponding compounds of methyle and ethyle; anisole boils at 305.6, and phenetole at 341.6.

Phenetole is a colourless, extremely mobile, liquid, of an agreeable aromatic odour. It is insoluble in water, but dissolves readily in alcohol and ether; it is not acted upon by a solution of potash either in the cold or with the assistance of heat. Concentrated sulphuric acid dissolves it, forming a conjugate acid, which furnishes a soluble crystalline salt with baryta. It is violently acted upon by fuming nitric acid. When the ebullition has been maintained for some time a yellow substance separates, which, washed with water and redissolved in alcohol, is deposited, on the evaporation of this liquid, in needles resembling binitroanisole. On analysis it furnished—

Carbon	44.71	16 = 96	45.3
Hydrogen	4.03	8 8	3.8
Nitrogen	13.03	2 28	13.2
Oxygen	"	10 80	37.7

This compound differs, therefore, from phenetole only in having 2 equivs. of hydrogen replaced by 2 equivs. of hyponitric vapour; it is consequently the homologue of binitroanisole. I shall call it binitrophenetole.

When currents of sulphuretted hydrogen and ammonia are simultaneously passed through an alcoholic solution of this substance sulphur is deposited; whilst the alcohol retains in solution a base which forms crystalline salts with sulphuric, nitric, and hydrochloric acids, and which itself crystallizes in brown needles resembling nitroanisidine. It furnished on analysis—

Carbon	52.60	16 = 96	52.7
Hydrogen	5.41	10 10	5.5
Nitrogen	"	2 28	15.4
Oxygen	"	6 48	26.4

This compound, which may be represented by the formula C^{16} H^{10} NO^2, NO^4, would be derived from the substance C^{16} H^{11} NO^2 by the substitution of 1 equiv. hyponitric vapour for one of hydrogen. Designating the normal alkaloid by the name of phenetidine, we shall give to the preceding compound, which is homologous with nitroanisidine, the name of nitrophenetidine.

Binitrophenetole furnishes, when treated with an excess of nitric acid, a new crystalline product, which is probably trinitrophenetole.—*Comptes Rendus*, May 7, 1849.

REMARKS ON M. DE LA RIVE'S THEORY FOR THE PHYSICAL EXPLANATION OF THE CAUSES WHICH PRODUCE THE DIURNAL VARIATION OF THE MAGNETIC DECLINATION.

In a letter to S. Hunter Christie, Esq., Sec. R.S.

By Lieut.-Col. SABINE, Foreign Sec. R.S.

[*Communicated to the Philosophical Magazine by S. Hunter Christie, Esq.*]

Woolwich, April 16, 1849.

My dear Sir,—The "Annales de Chimie et de Physique" for March last contains a letter from M. de la Rive to M. Arago,* in which a theory is proposed, professing to explain, on physical principles, the general phenomena of the diurnal variation of the magnetic declination, and, in particular, the phenomena observed at St. Helena and at the Cape of Good Hope, described in a paper communicated by me to the Royal Society in 1847, and which has been honoured with a place in "The Philosophical Transactions."

Although I doubt not that the inadequacy of the theory proposed by M. de la Rive for the solution of this interesting problem will be at once recognised by those who have carefully studied the facts which have become known to us by means of the exact methods of investigation adopted in the magnetic observatories of recent establishment, yet there is danger that the names of De la Rive and Arago, held in high and deserved estimation as authorities on such subjects, attached to a theory, which moreover claims reception on the ground of its accordance with "well-ascertained facts" and "with principles of physics positively established," may operate prejudicially in checking the inquiries which may be in progress in other quarters into the causes which really occasion the phenomena in question. I have thought it desirable, therefore, to point out, in a very brief communication, some of the important particulars in which M. De la Rive's theory fails to represent correctly the facts which it professes to explain, and

* A translation of this letter appeared in No. 138 of the *Chemical Times*, p. 330.

others which are altogether at variance with and opposed to it.

1. M. de la Rive's theory, in a few words, is as follows :—

In consequence of the inequalities of temperature in the higher and lower strata of the atmosphere, electric currents are generated, which in the higher regions proceed from the equator to the poles, and return at the surface of the earth from the poles to the equator ; the return current causing in the northern hemisphere the north end of the magnet to deviate in the one direction, and in the southern hemisphere in the opposite direction ; the deviation being at any given place greatest at the hour (about 1″.30 p.m.) when the difference of temperature in the upper and lower strata of the atmosphere is greatest, and of course increasing until that hour, and subsequently diminishing.

That the north end of the magnet does thus deviate in the forenoon towards the west in the northern hemisphere, and towards the east in the southern hemisphere, and return in both cases in the opposite directions in the afternoon, were facts known before the establishment of the magnetic observatories ; but M. De la Rive's explanation of them appears to have been suggested, and its appropriateness, as he considers, shown, by its affirmed accordance with the remarkable peculiarity in the phenomena made known to us by the observations at the Magnetic Observatory at St. Helena, and communicated to the Royal Society in the paper referred to. This peculiarity is briefly as follows :—The deviation which constitutes the principal part of the diurnal variation at St. Helena is not uniform in its direction throughout the year ; in one part of the year it is to the west, and in the other part of the year to the east ; and, consequently, during certain months of the year the movement of the magnet is in the contrary direction to that which prevails at the same hours during the other months of the year.

Now, St. Helena is situated within the tropics, and M. De la Rive infers from his theory that in all places so situated the diurnal variation should be in one direction when the sun's declination is north of the latitude of the place, and in the contrary direction when the sun's declination is south of the latitude of the place ; and hence he too hastily concludes that his theory accords with the characteristics of the diurnal variation at St. Helena ; when, however, the facts are more closely examined, it is seen that they do by no means accord with M. de la Rive's supposition.

That it may be quite clear that I do not misapprehend either M. De la Rive's theory, or his supposition in regard to the facts at St. Helena, I subjoin his own expressions, which convey his meaning, as that gentleman's writings generally do, with most commendable precision.

The first extract defines the limit which, according to his theory, should separate the electric currents proceeding respectively from each of the poles to the equator ; and should consequently separate the parts of the globe in which the diurnal variation is in the one direction, from the parts in which it is in the opposite direction ; whilst the second extract describes what he believes to be the facts of the phenomenon at St. Helena.

Extract 1.

"La limite qui sépare les régions occupées par chacun de ces deux grandes courants n'est pas l'équateur proprement dit, car elle doit être variable : elle est, d'après la théorie que je développe, celui des parallèles compris entre les tropiques, qui a le soleil à son zénith ; elle change par conséquent chaque jour."

Extract 2.

"A St. Hélène, la variation diurne a lieu à l'ouest tant que le soleil est au sud de de l'île, à l'est dès que le soleil est au nord. En effet, dans le premier cas, ainsi que j'ai remarqué plus haut, St. Hélène doit faire partie de la région dans laquelle les courants électriques vont sur la surface de la terre du pole boréal aux régions équatoriales ; et, dans le second cas, de la région dans laquelle ces courants vont du pôle austral vers l'équateur."

Whoever will be at the pains to refer to the paper printed in "The Philosophical Transactions" describing the phenomena of St. Helena, or to the volume containing the details of the observations on the diurnal variation in each month during the five years in which hourly observations were maintained day and night at that observatory, will perceive,—on evidence which admits of no uncertainty,—that the two portions of the year in which the diurnal variation is in contrary directions at that island are not determined, as M. de la Rive supposes, by the declination of the sun relatively to the latitude of the place, but by the declination of the sun relatively to the equinoctial line. The sun is vertical at St. Helena, passing to the south in the first week of November ; and, again, when passing to the north in the first week of February ; consequently, the two portions into which the year is thus divided are respectively the one of three, and the other of nine, months' duration ; but the actual portions in which the contrary diurnal movements of the magnets take place at St. Helena are of equal duration, and consist of six months and six months ; the dividing periods coinciding unequivocally, not with the sun's verticality at St. Helena, but with the equinoxes.

2. But if M. de la Rive's explanation be thus inconsistent in respect to the dates of the transition periods of the phenomena at St. Helena, it must be regarded as altogether at variance with, and opposed to, the phenomena described in the same paper at the Cape of Good Hope, where also they have been observed at the magnetic observatory at that station with an exactness which leaves no uncertainty whatsoever as to the facts themselves. The Cape is not situated within the tropics ; its latitude is 33° 56′ south ; the sun is consequently throughout the year well to the north of its zenith ; and, therefore, according to M. De la Rive's theory, the deviations should be in one and the same direction throughout the year. But the fact is not so ; for the same contrariety in the direction of the diurnal variation at different portions of the year takes place at the Cape as at St. Helena ; the two portions of the year in which the opposite phenomena prevail are also identical at the two stations ; and at both the change in the direction of the deviation takes place when the sun crosses the equinoctial line ; the deviation being to the west at both stations when the sun is in the northern signs, and to the east when he is in the southern signs.

3. But in considering a theory which comes before us, claiming the high distinction of affording a physical explanation of facts which are known to us by well-assured observation, we ought not to confine our view to those points only for which it professes to supply the explanation : these are certainly tests as far as they go ; and in the present instance the conclusion from them is not favourable to the theory proposed ; but we should also notice its deficiencies, or those points wherein it neither furnishes, nor attempts to furnish, explanations of circumstances which are certainly amongst the most remarkable facts of the case. They may be possibly amongst the most difficult to explain, but no physical theory can be regarded as meeting the facts which does not at least attempt an explanation of them. I may name as the most prominent in interest amongst these the striking fact that the Cape of Good Hope should be one of the stations at which this remarkable peculiarity of a contrariety of movement at different periods of the year takes place.

It is known that it does not occur at places situated in corresponding latitudes north of the geographical equator ; at Algiers, for example, which is, moreover, nearly in the same geographical meridian as the Cape, and where the magnetic inclination is nearly the same towards the north as is the case at the Cape towards the south. It may be quite correct perhaps to view the corresponding phenomena at St. Helena and the Cape as those belonging to magnetically-equatorial stations ; but they are certainly not those peculiar to or characteristic of geographically-equatorial stations, which would be the condition in M. de la Rive's theory. There are thus two parts in the problem demanding physical explanation ; on the one hand, the cause is required of the contrariety of movement, as well as of the times at which the different movements occur, the latter having obviously a dependence on the sun's position either in the northern or the southern signs ; and on the other hand, the cause must be shown why certain stations are thus affected and others not : a distinction which obviously does not depend on situation in regard to the geographical equator or to the tropical divisions of the globe.

I have myself been led to infer that the peculiarity in question results from and is indicative of proximity to the line of least magnetic force, regarded as physically the separating line on the surface of the globe between the northern and southern magnetic hemispheres ; the peculiarity would thus be strictly a magnetically-equatorial one.

It results from the present position of the four points of maximum intensity at the surface of the earth that the intermediate line of least intensity departs considerably in the Southern Atlantic from the middle or geographically-equatorial portion of the globe, passing between the Cape and St. Helena, and consequently not far from either of these stations.

As far as I have yet been able to examine, I have found that the same remarkable peculiarity does exist at all other stations which are near this line, and at none which are remote from it. But, however this may be, the accordance of the phenomena at the Cape of Good Hope and St. Helena, and their dissimilarity from those at other stations, is a well-ascertained fact, of far too much bearing and importance to be passed without notice ; and we may safely anticipate that its cause must occupy a prominent place in the theory which shall be ultimately received, as affording an adequate solution of the problem of the diurnal variation.

Believe me, my dear sir, sincerely yours,

EDWARD SABINE.

S. H. Christie, Esq., Secretary
to the Royal Society.

ON A NEW APPLICATION OF PLATINUM TO PAINTING UPON PORCELAIN.

By M. SALVETAT.

When 1 part of platinum powder is mixed with 3 of a glass prepared with 3 parts minium, 1 part sand, and ½ part calcined borax, a grey of the very finest tone for porcelain is obtained, the advantages of which over all other grey colours are readily perceptible.

In all cases where the oxides of iron, cobalt, manganese, and copper come in contact with a substance containing a large quantity of silica, and the temperature rises so high that the latter begins to fuse, the colour of the compound substance formed is always black, whether the oxide of cobalt was previously blue or not, the iron red or brown.

Upon this behaviour is based in general the process for preparing grey and black colours for painting upon porcelain or glass. Different tints and depths of colour are obtained by varying the proportions of the several oxides of iron, cobalt, and zinc ; and by adding the flux for the grey, the composition of which is given above, in greater quantity, a lighter and lighter grey is constantly obtained. But the blue colours consist of cobalt and zinc ; and the freer the oxides are from iron, the more beautiful and pure is the blue. Peroxide of iron furnishes the red colours. Ochre-yellow is produced by oxides of iron and zinc ; and these colours only exhibit a clean appearance when both these oxides are free from other metallic oxides, especially from the oxides of manganese and copper. It is evident, there-

fore, that the artist, when he wishes to modify the blue, red, and ochre-yellow by mixing black or grey with them, has to form a mixture of peroxide of iron, oxide of cobalt, and oxide of zinc in undetermined proportions, the colour of which is black; so that he is only able from very great practice to determine in advance the tint and intensity of the colour. Moreover, as the tone of the colour after the burning is not the same as before, since the blue and red tints may be altered, nay, have even entirely disappeared, he is unable to give the painting the appearance it will have after the firing. This is a serious inconvenience, especially in the painting of figures.

The platinum grey is free from all these evils. As it contains no cobalt, it may very well be mixed with red and ochre-yellow; nor does it affect the blue, as it contains no oxide of iron. It produces in a mixture only that tint which is peculiar to it, and retains it even after the burning. Platinum grey can, moreover, always be prepared of the same tint. The platinum powder is readily obtained by calcining ammonio-chloride of platinum, and it has then only to be mixed in the above proportions with the flux. Platinum is not the only metal which can be used for grey colours for porcelain; all those metals which constitute the platinum ores can, when properly diffused, be employed with greater advantage than the grey from the oxides of iron and cobalt. The author has tried palladium and ruthenium; the former gives a paler grey than platinum, and ruthenium a grey with a brownish-red tint. The sesquioxide of iridium has long been employed by M. Frick for black colours for porcelain, and experience has shown that it is preferable to all other similar colours. The author has since 1845 furnished more than 100 grms. of iridium grey for the Sèvres manufactory, where it is in daily use. Platinum grey may be advantageously substituted for it; it is cheaper, its tone more agreeable, and its preparation more easy. It is likewise more generally distributed; and during the year that this colour has been used experience has proved its value; it is now generally employed at Sèvres.—*Ann. de Chim. et de Phys.*, xxv., p. 342.

DESCRIPTION OF A NEW PROCESS FOR DETECTING IODINE AND BROMINE.

By M. REYNOSO.

The method employed for detecting these substances when they exist in the state of iodides or bromides consists in dissolving them in water, adding starch in the state of paste, or some ether and a few drops of chlorine-water. The chlorine combines with the metal, setting free the iodine or bromine, which colours the starch blue or dissolves in the ether; but as iodine and bromine possess the property of combining directly with chlorine, forming a chloride of iodine or of bromine, the chlorine must not be employed in excess for detecting the presence of these bodies, because the chlorides of iodine or of bromine are decomposed in contact with water, producing hydrochloric acid and iodic or bromic acid, both of which are without action upon starch or ether.

This method requires great precautions, and is not at all applicable for the detection o minute quantities of iodides or bromides, especially when these substances are mixed with others capable of combining with the chlorine. It became, therefore, important to discover a substance which would isolate the iodine or bromine without acting upon them, however large an excess were employed. These conditions are all combined in oxygenated water; it decomposes hydriodic or hydrobromic acid, and has no action upon the liberated iodine or bromine.

The following is the mode of proceeding for detecting iodine:—In a small tube closed at one end is placed a fragment of deutoxide of barium, to which is then added some distilled water, pure hydrochloric acid, and some starch paste; we then wait until some bubbles are seen to rise to the surface before adding the iodine; in an instant a pinkish-blue colour is evident if the quantity of iodine is very small, and a dark blue if it be considerable. It is advisable to make the experiment as directed, both as regards the manipulation, which is rendered very easy, and also as regards the success of the experiment. In this manner we are sure to employ an excess of oxygenated water, which is requisite when hyposulphites, sulphites, or sulphurets are present; moreover, the hydrochloric acid employed in the preparation of the oxygenated water likewise plays an important part, for it serves to liberate the hydriodic acid—

$BaO^2 + 2ClH + IH$, $KO + HO = BaO$, $ClH + KO$, $ClH + 2HO + I$.

Although it is beyond doubt that hydrochloric acid, when acting upon the peroxide of barium in the presence of water, gives rise to the production of oxygenated water, I resolved to assure myself that it was the HO^2 which produced the result obtained. I therefore substituted tartaric acid for the hydrochloric acid, and obtained the same result.

The decomposition of hydriodic acid by pure oxygenated water had already been pointed out by M. Thenard.

When the iodides occur mixed with chlorides, sulphurets, sulphites, or hyposulphites, the process is just as accurate; only, as, by the action of the hydrochloric acid upon the sulphuret, sulphuretted hydrogen is produced, which is decomposed by oxygenated water, and the sulphites and hyposulphites absorb oxygen in passing into the state of sulphates, a larger quantity of oxygenated water must be employed than if the iodide were pure.

The hyposulphites and sulphites on their conversion into sulphates produce a precipitate of sulphate of baryta in the liquid, which might arrest the reaction if the sulphate of baryta were not removed from the surface of the deutoxide of barium by agitation; this precaution, moreover, should never be neglected, in order to increase the production of oxygenated water. By this process I readily detected the presence of iodine in the urine of a patient to whom 0.10 centigramme of iodide of mercury was administered morning and evening, whilst chlorine failed to detect the presence of the iodine. This process likewise demonstrates the presence of iodides in the ash of the sponge. One drop of a solution of 0.010 grm. of iodide of potassium dissolved in a quart of water produces, each time that it falls into the tube, a blue colour sufficiently distinct at the surface. On agitating, the blue colour disappears, and the liquid acquires a rosy tint; on adding a fresh drop the blue colour again makes its appearance at the surface. This method, therefore, readily indicates less than $\frac{1}{100000}$th of iodide of potassium.

The process is the same for bromine, except that, instead of starch, ether is added. It is agitated when the bromine dissolves in the ether, and communicates to it a more or less dark yellow colour, according to the quantity present. But, when we have a mixture of iodides and bromides, their presence may be ascertained by adding an excess of starch and ether; the iodine combines with the starch, whilst the bromine being taken up by the ether comes to the surface; and in this manner a blue colour is obtained below, and a yellow above.—*Comptes Rendus*, April 30, 1849, and *Chemical Gazette*.

Edmund Grundy, of Bury, in the county of Lancaster, woollen-manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool and other fibrous substances. Patent dated May 29th, 1849; six months.

THE CHEMICAL TIMES.

SATURDAY, JUNE 9, 1849.

THE LATE PROCEEDINGS OF THE APOTHECARIES' COMPANY AGAINST A DULY QUALIFIED PHYSICIAN.

It appears that the Medical Protection Society, and its allies of the Hall, continue as determined as ever in their iniquitous purpose to annoy and harass the *non-licensed* members of the medical profession. The success which the proceedings of these gentry meet with is very indifferent indeed; yet it would seem that no failure, however so decisive, can abate their ardour. The case which they managed to get up a few weeks ago against Dr. Kelly, of Pinner, presents points of peculiar interest, demonstrating, as it does, to evidence the miserable prostitution of the Apothecaries' Act to the basest of all purposes. Dr. Kelly is a duly qualified physician, and one of the most successful practitioners in the county of Middlesex. He has been established at Pinner for some twenty-three or twenty-four years, has held the appointment of parish surgeon for years, and enjoys a great and well-deserved reputation for professional skill. One would have thought that the protection crew would leave *such* a man alone, at all events, and so they most probably would, had it not been for the miserable vindictiveness and personal *pique* of an individual against whom Dr. Kelly had had to proceed some time since for the recovery of a debt, and who had been cast in three successive actions. This individual, enraged, no doubt, at the repeated defeats which his attempts to withhold payment of a debt *justly* due had met with, resolved, as a last resource, to work the Apothecaries' Act against his opponent. He communicated with one of the *noble* agents of that most glorious body of men yclept the "Medical Protection Society," and the two worthies—

"Par nobile fratrum—
Arcades ambo"—
(*vide* Lord Byron's translation)—

set about with a will concocting a grand scheme of attack against the unfortunate physician who had had the audacity to insist upon the repayment of money lent to a "friend." The requisite evidence was gathered—(at all events the informer and his abettors *fancied* they had got hold of it)—and the information laid. The action came off in the County Court at Watford, and the company were nonsuited, there being no evidence whatever adduced on the part of the plaintiff that the defendant had dispensed medicines in the common sense and acceptation of the term. The jury, moreover, indignant, no doubt, at the villanous attempt to crush a man deservedly respected by rich and poor, both for his high professional attainments and kindness of disposition, expressed themselves explicitly to the effect that, had the court not deemed it its duty to nonsuit the plaintiff, they (the jury) would have unanimously returned a verdict for the defendant. The issue of this trial is satisfactory, indeed, and must prove highly gratifying to the thousands of medical men and chemists and druggists who

see themselves threatened with similar proceedings, and who may now entertain a well-founded hope that the "act" is, after all, not the formidable and crushing engine which Mr. Breary and his associates of the Medical Protection Society fondly imagined it to be, and that there are a great many loopholes left in it "not dreamt of in Mr. Griffits' philosophy."

We trust, however, that this circumstance will not induce in those who are liable to be attacked under the act a feeling of security, and render them less determined in their opposition to the act itself. That act must be torn from the statute book, for, as long as it is permitted to remain in force, no non-licensed member of the medical and chemical professions can feel quite safe.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION.

On the 26th ult. Professor Faraday delivered the fourth lecture of his course at the Royal Institution. The power which an excited electric possesses of inducing electricity in other bodies, without contact, formed the chief subject of his discourse, which was illustrated by a great number of curious experiments. When an excited glass rod is brought near to an electrometer, the divergence of the leaves shows that the glass imparts electricity to bodies not in contact with it, through the air, which is a non-conductor of electricity. This property of induction is, indeed, only manifest through non-conducting bodies, and it increases in proportion to the non-conducting property of the bodies through which it is transmitted.

When shellac, gutta percha, and a thick mass of sulphur were interposed between the electric-rod and the electrometer, the divergence of the gold leaves was rather increased than diminished, though it might, on a first consideration, appear that the effect of the interposition of such an insulating mass would have been to obstruct the passage of electricity altogether. An insulated brass cylinder, in which electricity was induced by an excited glass rod, emitted a spark which set fire to a jet of gas; and this effect was frequently produced both when the excited electric body was removed, and when it was brought near.

When electricity is induced in a body by the approach of an excited electric, that body is influenced only so long as the excited electric continues near, and the exciting cause being removed the electrical condition is lost; but if, when an insulated body is under the influence of an excited electric, a temporary connection be made between it and the ground, and the electric be then removed, the insulated mass will retain an electric charge of the opposite kind to that of the original exciter. The action of induction is extended through infinite space, and, whenever electricity is excited in a body, all other bodies, however remote, are influenced by it, though the effect diminishes, of course, with the distance.

As an illustration of the extended influence of induction, a large metal globe, suspended with gutta percha in the middle of the lecture-room, was electrified by a few turns from the electrical-machine; and Professor Faraday, by holding an insulated piece of gold paper at a considerable distance from the globe, obtained from it a quantity of electricity sufficient to sensibly affect the electrometer. The same influence which operated on the gold paper was, he observed, operating on every person present, as it does not require insulation to produce the effect, the object of insulation being merely to continue the effect after the exciting cause is removed.

One of the chief characteristics of static electricity is, that positive electricity is never excited without negative, and in the phenomena of induced electricity this character is strongly marked. When, for example, an excited glass rod is brought near to an insulated cylinder of brass, that part of the metal nearest the glass is charged with negative electricity, and the farthest extremity is charged with positive electricity. When under these circumstances the farthest extremity of the metal is touched with a discharger, and the excited glass rod is afterwards removed, the insulated metal continues charged with negative electricity. Several experiments were shown illustrative of this property, in some of which the electricity induced on Professor Faraday's hand, though he was not insulated, served to repel bodies on which electricity of the same kind had been induced. It is a consequence of the property that one kind of electricity cannot be induced without the other that conductors convey electricity on their surfaces alone, and that the interior of any metallic vessel is not electrical even when the exterior surface is highly charged. To illustrate this fact, an icepail, placed on an insulated stand, was charged with electricity, and, though the outside gave strong indications that it was charged, a metal ball introduced inside, and then applied to the electrometer, did not affect it in the least. In another experiment a tame white mouse was enclosed in a wire-gauze cylinder, in connection with the prime conductor of the electrical-machine, and from the outside of the cylinder powerful sparks were taken close to the animal, but it did not appear at all disturbed.

The effect of induction in producing the phenomena of repulsion was exemplified in a striking manner. A number of long strips of paper, when electrified, repelled each other with great force, as if they were actuated by a repelling power. They were then tied together at the bottom and again electrified, when they took the form of a balloon; but it was shown that this action was not caused by a repelling power among the strips of paper, but by the attracting power of surrounding bodies in which electricity was induced; for, when the hands were held near, the balloon became much more inflated, being evidently attracted on both sides, externally, instead of having a repulsive action from within.

ROYAL DUBLIN SOCIETY.

Professor Barker brought under the notice of the society a bottle containing a portion of black rain, which had been transmitted to him from Carlow, with a view to satisfy the scruples of many persons who appeared to doubt that rain of this description had fallen. He (Dr. Barker) had, however, received several communications on the subject of this rain, from parties residing in several of the districts in which it had descended; and he was in a position to state, not only that such rain had actually fallen, but to mention the space of country upon which it fell.

The specimen he presented had been sent to him from Carlow, accompanied with a letter, in which the writer mentioned that at the time of its collection it was uniformly black, and very much resembled ordinary writing ink; but he (Dr. Barker) found that, after allowing it to stand for a short period, the black colouring matter separated from the water with which it had been mixed, rendering the colour of the rain much lighter than at first. The places in which he had ascertained it to have fallen were Abbeyleix, Carlow, Kilkenny, and Athy, from which it would appear that the black shower had extended over an area of more than 400 square miles. With respect to the time when it fell there appeared to be some vagueness in the letters he had received, but as well as he was able to ascertain the fact it would seem that it must have occurred about six o'clock on the evening of the 14th instant, being preceded by such extreme darkness that it was impossible to read except by candlelight. After this darkness had existed for some time a hailstorm, attended with vivid lightning, but without thunder, occurred; and when this subsided this black rain fell.

It was mentioned by his Carlow correspondent that upon examining a portion of it, just after it had fallen, he found it had an extremely fœtid smell, and a very disagreeable taste; that it left a stain upon some clothes which had been left to dry in the open air; and that upon offering it to some cattle they had refused to drink it.

In Abbeyleix, where the shower descended at the same moment, the appearance of the rain was precisely similar to that which fell in Carlow, but unaccompanied with the lightning which was there observed; and in Athy a hailstorm took place in the first instance, which was followed by the rain. Dr. Barker then proceeded to observe that as yet he had not been enabled to make a complete chemical analysis of the rain, but that he wished in the meantime to lay before the society an account of the appearances it presented when seen under the microscope.

Some of it had been recently examined by Drs. Harvey and Steele with the aid of this instrument, and it would appear that, although a few small confervæ were observed in it, their presence was accidental; and that the black particles did not consist of organized matter, in which opinion he (Dr. Barker) was disposed to concur, inasmuch as the colour of these black particles was wholly unchanged under the influence of chlorine gas, strong sulphuric acid, and caustic potash. It was in the next place conjectured that the black particles were composed of some species of fungus, but this supposition was negatived by the investigation of Drs. Harvey and Steele, who proved that they were not of an organic nature. At the time this rain came into his (Dr. Barker's) possession it had neither smell nor taste, and became perfectly colourless when allowed to stand for a short period, and he consequently looked upon it as pure water mixed with some organic substance. The learned professor stated that appearances similar to those presented by this rain had been observed in various places on former occasions. It was recorded, for example, that a black shower, principally consisting of ashes, fell some years since at La Paz, in Peru. A similar phenomenon was observed at Barbadoes, and it was known that rain of a pure black colour had descended at Montreal, in Lower Canada, some years ago. In Germany, likewise, rain of a dark rolour, and of a gelatinous consistency, was not long since observed. Now, there were three different suppositions upon which this occurrence of black rain might be explained. In the first place, it had been suggested that it was caused by a great cloud of soot which had gathered above the particular tract of country upon which it was deposited; but he did not think this explanation of the matter was borne out by the facts; for, in the first place, its blackness was not identifiable with the jet black hue of soot; and, secondly, the coals used in the part of the country where it fell produced no soot during their combustion.

But it was suggested that clouds containing soot might be brought across the channel from England by electric attraction, which was known to occur between clouds, and thus become deposited in the localities where this rain was remarked to have fallen; but when he recollected the large extent of country which it covered, namely, an area of 400 square miles, he thought it quite impossible that a quantity of soot sufficient to cover this large tract of country could be supplied from London, Birmingham, or any similar source.

Another mode of explaining this phenomenon was by the supposition that it was of volcanic origin, and it was possible that such might be the case; but this was a point that could only be settled by chemical analysis, and by their receiving an account of some violent volcanic eruption. It was an established fact, bearing upon this curious species of rain, that the ashes of a volcanic eruption which took place in the South Sea Islands had been carried to a distance of some thousands of miles from those islands. A third method of accounting for this remarkable rain, and one to which some degree of probability

might be attached, was, that the black particles floating through it might be found to possess the same chemical constitution as the dust of which aërolites were formed. They knew that a quantity of meteoric masses were constantly floating through the regions of space, and it was very possible that when these masses crossed the earth's orbit they were broken across, and a portion of them brought within the atmosphere of the earth, and within the sphere of its attractive force. Now, this was a point that might be ascertained, provided they could procure a sufficient quantity of the rain, for, having already examined these meteoric masses, they were aware they contained some rare metals which were never met with in volcanic ashes; and consequently, if these metals were found in the rain, no doubt would any longer exist as to the origin of the colouring matter of the rain.

Professor Barker promised to communicate to the society the results of the analysis he intended to make of this singular substance.

ROYAL COLLEGE OF CHEMISTRY.

On the 4th inst. the annual meeting of the members of this college was held at the institution in Oxford-street, Sir C. Lambe in the chair. The report of the council stated the gratifying fact that they had succeeded in paying off the debt which had so long encumbered them; and the removal of the college from Hanover-square had caused a considerable reduction of expenditure. It was very desirable that a proper lecture theatre should be constructed; the cost of it would not exceed £1,800, and it would render the establishment complete in all its appointments, besides forming an excellent hall or room for the holding of scientific *soirées*. The report of Dr. Hoffman stated that the number of pupils was on the increase, and, upon a review of the proceedings of the past year, it seemed likely that the object of the college, namely, to send forth a number of students, of all classes, capable of applying a thorough knowledge of chemistry to useful and commercial purposes, would be accomplished. The balance-sheet stated that at the commencement of 1848 there was a sum of £543 12s. 4d. to the credit of the college, and that balance, joined to the income from all sources, made a total of receipts for the year of 3,191 12s. 4d. The expenditure had fallen short of that sum by £400 7s., which remained as a balance. This report was agreed to, as was also a vote for the reduction of the members of the council from thirty-six to eighteen. A cordial expression of the thanks of the meeting was given to his Royal Highness Prince Albert, the president of the college. The meeting separated after the usual annual election of officers, and after a vote of thanks to the chairman.

ST. PETERSBURG ACADEMY OF SCIENCES.

In 1845 a detailed communication was made to the academy of a double series of experiments made at Poulkowa, according to the plan indicated by M. Struve, for the purpose of determining the exact coefficient of the dilatation of ice, by the action of heat. The question was still left in much incertitude, on account of the great variation in the results obtained by the different investigations.

M. Schumacher, jun., of Altona, found that the dilatation of ice for a change in temperature of 80° Beaumé (212° F.) was 1-191 of its total length, and that it increased in a uniform manner in ratio of the temperature. The second observer, M. Pohrt, has also completed his experiments, conducted in some respects on a different plan to those of M. Schumacher, but, having quitted the office he held at the observatory, left his calculations in an unfinished state.

M. Struve entrusted this work to a young savant of Dorpat, who settled for some time at Poulkowa for this purpose. M. Moritz not only examined with the greatest care and diligence the results obtained by M. Pohrt, but made a series of experimental researches himself. The agreement of these results is very satisfactory; and that of M. Moritz giving for the coefficient of dilatation the arithmetical mean of the other two observations, viz., 1-193, this result must be considered as definitive. Consequently, the dilatation of ice is greater than that of any other known solid body, absolutely uniformed, and the same in the directions of its three principal axes.

ON THE SAFETY-LAMP OF M. ROCOUR.

The safety-lamp of Rocour is, like the lamps of Davy, Museler, and others, composed of a reservoir for the oil, which serves as the foundation. On this reservoir are placed two cylindrical glasses, one of which is placed within the other, leaving a surrounding space of from six to eight millimetres. The inner glass is surmounted by a chimney of iron-wire gauze, which serves to conduct the products of combustion to the top of the lamp. Below the empty space left between the two glasses, a wire gauze admits the supply of air, and conducts it to the lower part of the lamp underneath the flame. Above the same space there is another piece of wire gauze which covers it again at the bottom of the chimney. This wirework divides the distance between the two glasses from the wire-gauze cylinder, which covers the whole apparatus. Consequently, before the air reaches the flame, it has to pass through three wire gauzes instead of one only, as in other safety-lamps. The combustion of the air takes place after having passed through three wire gauzes, and it is conducted to the burner by passing through the space contained between the two cylindrical glasses, which separates the flame from the external air; the products of combustion then escape by means of the chimney placed above the outer glass, and thence they pass through the cylinder of wire gauze into the open air.

The following is the result of this ingenious combination:—When the inflammable gas in the interior of the works is abundant the flame enlarges, and produces a great quantity of incombustible gas, which, becoming mingled with the supply of air as it enters, very quickly contaminates it, and occasions the immediate extinction of the flame. This has been proved by many experiments in a coal-mine in the district of Charleroi, where the carburetted hydrogen gas escaped in such abundance that the cylinder of wire gauze of one of Davy's lamps was continually filled with the firedamp in a state of combustion, and which would infallibly have occasioned an explosion if the lamp had not been taken away before the fusion of some of its parts. The Rocour lamp is quickly extinguished in this dangerous atmosphere. The superiority of this lamp is then evident, on all occasions when the gas from the veins of workable coal escapes in such large quantities as to endanger the lives of the workmen. We shall proceed to give a brief explanation of the physical phenomena produced by the result we have just mentioned. The supply of air, as we have stated, enters by means of the upper wire gauze; it is separated from the gases, the products of combustion, by the gauze chimney, and by the inner glass; it afterwards passes through the upper wire gauze, then the lower one, from whence it reascends towards the flame. One of the two glasses might, therefore, be broken without endangering the safety of the lamp. It may also be moved in every direction; and the flame will always remain separated from the incombustible gas that it produces. The Davy lamp, as is well known to all coal-miners, is composed of a wire gauze, through which the air and gas pass. The result is, that, when it is placed in an explosive mixture of the two, the portion which enters the lamp becomes inflamed, and, being continually supplied by additional quantities of the inflammable gas, it will eventually render the wire gauze red hot. Then, every obstacle being removed, detonation, with its terrible consequences, takes place. There is another consideration: the flame of the Davy lamp, being enclosed in the wire gauze, emits only a feeble light.

M. Museler, sub-engineer of the mines at Liège, commenced the improvement of safety-lamps in Belgium. In 1829 he had already introduced some successful improvements in the Davy lamp. But it was in 1840, especially, that he led the way to the improvements which have produced a complete alteration in the construction of safety-lamps. Though the principle of his lamp is incontestably excellent, it is, nevertheless, not exempt from some imperfections. It has only one glass between the flame and the external air, which, being liable to become very much heated, is subject to be broken by being suddenly cooled; for instance, by the falling of a few drops of water, which frequently occurs in coal-mines. In the Museler lamp, the separating space between the current of descending air and that of the ascending burnt gases being situated above the wick at the base of the metallic cone, the consequence is, that, when the lamp is inclined, the burnt gases, being driven back again, either extinguish the flame, or diminish its intensity so considerably that its light becomes insufficient. The very small inclination of from ten to fifteen degrees is sufficient to produce this effect, which is a great inconvenience in the low and irregular galleries of the generality of our coal mines. The Museler lamp will, however, resist a mixture of air and pure hydrogen gas. M. Rocour has fortunately overcome the two inconveniences noticed in the Museler lamp. The outer glass of his lamp, being always placed between the current of fresh air which supplies the flame in its progress through the two glasses and the external air, does not become heated, and is not liable to be broken by being cooled too suddenly, nor would even the breaking of the glass in any way diminish the safety of the lamp. In consequence of the separation of the consumed gases from the fresh air which is admitted underneath the flame in this lamp, it may be inclined even horizontally without extinguishing the flame, and the light continues the same in whatever position it is placed. The Rocour lamp, like the Museler lamp, resists a detonating atmosphere of air and pure hydrogen when the apertures of the wire gauzes are 121 to the square centimetre.

With respect to the quantity of light, the Rocour lamp has certainly the advantage of the Museler lamp, because the gauze chimney of the latter, descending low on to the flame, absorbs the most brilliant rays; whilst in the other the chimney, being placed above the interior glass, leaves all the flame exposed, and diffuses its light to advantage. The lamp of M. Lemielle, of Liége, is a Davy lamp; it consumes the firedamp which enters through the wire-gauze cylinder, and it is consequently subject to the same inconvenience. Its only advantage is, that it gives more light than the Davy lamp; it is also less expensive than the lamps of Museler and Rocour. Experiments, frequently repeated, have demonstrated that a Lemielle lamp gives as much light as four Davy lamps; the Museler lamp as much as five; and the Rocour lamp as much as six, or even seven, Davy lamps.

ON CASTING IN BRONZE.

It was in France, under Louis XIV., that the art of casting in bronze suddenly elevated itself, under the intelligent efforts of the brothers Keller.

The principal masterpieces of these two great artists still decorate the palaces of Versailles and the Tuileries. Balthasar Keller made, in 1699, at a single casting, the equestrian statue of Louis XIV., of which the model was executed by Girardon. This colossal mass was seven metres in height, and weighed only 26,072 kilogrammes.

But the art of bronze founding seemed at this epoch to have obtained celebrity, only that it might make its admirers regret the more the rapidity of its decline. The equestrian statue of Louis XV., cast after the model of Bouchar-

don, and which was placed some years after in the Place de la Concorde, was also founded at a single casting, by Gor. The height of this statue was only 5 metres 40 centimetres (about 18 feet), but its weight was 20,370 kilogrammes (nearly 20½ tons).

During the revolutionary troubles the manufacture in bronze was limited merely to cannon; but under the empire bronze was again called upon to take part in the combination of arts which celebrated the triumphs of the French arms. Unfortunately, this fine art had been neglected; it was no longer practised by special and experienced artists, and the first efforts of the novices were by no means successful. The statue of Dessaix was a complete failure; and the column of the Place Vendôme is far from being a *chef-d'ouvre*.

When, in 1817, Lemot was entrusted with the casting of the equestrian statue of Henry IV., which stands on the Pont Neuf, he had the precaution to take at Versailles samples of the bronze in the three fine statues of Keller, which have the highest reputation, both as regards execution and casting, being of the true green shade, and of admirable proportions. The following are the results of the analysis of these three specimens :—

	No. 1.	No. 2.	No. 3.	Mean.
Copper ..	91.30	91.68	91.22	91.10
Tin	1.00	2.32	1.78	1.70
Zinc	6.09	4.93	5.57	5.53
Lead	1.16	1.07	1.43	1.37
	100.00	100.00	100.00	100.00

Lemot believed himself sufficiently informed by this analysis; but he did not the less encounter serious accidents in the casting of the statue. He wished to avail himself of the furnace which had been constructed to cast the equestrian statue of Louis XV.; but this furnace had not been arranged in a manner to produce a draw sufficient for the perfect fusion of the alloy of Keller, in which there entered a proportion of copper much stronger than that of the statue of Henry IV. After several trials he was obliged to modify it; but still the final casting did not succeed perfectly. The body of the King had several inequalities in it, and the lower part of the belly of the horse was spoiled; a large hole formed in it, which it became necessary to stop up; and, finally, they resold more than 14,000 kilogrammes of the oxidized materials.

The casting of bronze, though offering no great difficulties in the manufacture of articles of small dimensions, presents very great ones when it is required in large masses, and in statues of human form. The constituent metals have no strong affinity to each other; the metals, when fused, have a tendency to separate, according to their specific gravities; and, when the least fusible begin to acquire solidity, the others in a liquid state ascend, until the easy oxidation of a composing part of the alloy leaves ground to apprehend the separation of the metals.

Independently of these difficulties, there are others to be encountered of an equally serious nature, in the calculation of component parts of the bronze, especially when a given quantity of metal is required, in the preparation of the mould, the construction of the furnace, &c.

These difficulties, and many others that we could enumerate, will explain why so many miscarriages have at different times attended the casting of a large piece of bronze. They enable us to understand why Falcounet passed fifteen years in founding the equestrian statue of Peter the Great, which figures on its immense pedestal of a single stone block at St. Petersburg; why the Kellers were nine years founding the statue of Louis XIV.; why Bouchardon and his successor Pigalle were seven years founding that of Louis XV. in the Place de la Concorde; why the grand equestrian statues that we have above noticed did not come perfect from their moulds; and, lastly, why the statue of Dessaix, and we may almost say the column of Vendôme, have been failures. Bouchardon had considerable trouble to produce the delicate forms of the horse of his fine equestrian statue of Louis XV., which came badly from the mould in the lower parts; and we have related the difficulties that Lemot and Piggiani encountered in casting the statue of Henry IV., a work which occupied them four years.

In order to understand the difficulties which were surmounted in the casting of the column of July, as well as the successful innovations introduced by the founder, let us compare this work with that of the column Vendôme, the only monument presenting any analogy to it. In addition to the fact that the column Vendôme has only a coating of bronze, we have to state that the largest pieces which compose it are only five metres, or thereabouts. Each portion of the shaft of the column consists of six pieces, and yet the column Vendôme cost two millions of francs. The column of July, on the contrary, is entirely composed of bronze; every portion of the shaft is a single piece; the base of the column is nearly sixteen metres, and the capital, at its widest part, attains the enormous dimension of twenty-six metres. The column of July cost, however, only 1,172,000 francs.

The inequality of the thickness of different parts constitutes one of the great difficulties of bronze casting, because the thick parts do not cool as soon as the others. The contraction of the first takes place sooner than that of the last, which tends to produce fissures. We can equally conceive that the contraction of a piece of metal must be greater in proportion to its dimensions; and the necessity of keeping in mind this consideration offers a new difficulty in the manufacture of the mould, which ought to be calculated in relation to the anticipated attraction. It is easy to understand that the least movement in the mould during the operation would cause much deviation from the required thickness. The preceding observations are more than sufficient to enable our readers to appreciate the difficulty with which the different pieces of the column of July were cast. As to the statue which surmounts it, we cannot do better than republish an extract from the report made by M. Héricort de Henry to the Societé d'Encouragement, in the name of the committee of mechanical arts, on the improvements introduced by M. Soyez in the moulding of statues in bronze :—

"This statue, four metres twenty-five centimetres in height, resting on the toe, and inclining very much forward, presented very great difficulties in the moulding, and greater difficulties still in the casting; the solidity of the statue depending, in a great degree, on the extreme lightness of the upper parts, and the weight of the limb on which it rests.

"If the old process had been followed, it would have been found necessary to cast this statue in several pieces; for the upper part, being thin, must cool immediately; while the lower, cooling much more slowly, would be drawn back upon itself, producing a division at the hips of about 25 millimetres, the metal contracting from 12 to 14 millimetres per metre, so that the statue would have been inevitably destroyed.

"To obviate the difficulties that the casting of this statue presented, M. Soyez determined to run it with the head downward, and by this means diminish the danger. We say diminish, because by this arrangement the mould must either give way, or the leg break above the ankle. To guard against this latter danger, M. Soyez fixed at each side of the foot a piece of copper, 0.66 in. in width, terminating in a strong head, so as to force the foot to draw back towards the knee; these plates were finally so combined as to have less thickness than the leg. That which had been anticipated happened; the plates of copper forced the foot to follow the movement of the leg. Full success crowned the experiment of this bold and ingenious innovation; the casting of this admirable statue succeeded perfectly in all its details. It is the first time, perhaps, that a figure of any importance has been cast without a defect. The thickness of this statue is from 4 to 5 millimetres in the upper parts, excepting the wings, which have only 2 millimetres; the leg having 55 millimetres, commencing from the ankle, diminishes progressively in diameter as far as the thigh."

VACCINATION IN ENGLAND.

The following is a copy of the report of the National Vaccine Establishment for the year 1848-49, addressed to the Secretary of State for the Home Department :—

"TO THE RIGHT HON. SIR GEORGE GREY, BART., M.P., HER MAJESTY'S SECRETARY OF STATE FOR THE HOME DEPARTMENT.

"May 26.

"Sir,—The board have the satisfaction of reporting that their foreign and domestic correspondence continues to furnish testimony of the efficacy of vaccination in the great majority of cases.

"During the past year 174,991 charges of lymph have been distributed, and 11,790 children have been vaccinated by the surgeons appointed in the London districts. The board have likewise received returns of 88,482 cases vaccinated with lymph sent from the office of the National Vaccine Establishment.

"The board have furnished large supplies of lymph for the use of the army and navy, and they rejoice that it thus falls in the course of their duty to transmit the genuine lymph to a large body of men amongst whom it is almost impossible to keep up a self-supply.

"In consequence of an alarming prevalence of smallpox in several of the West India islands, orders have been received from the Under Secretary of State for the Colonies that lymph should be forwarded by every packet in addition to the usual periodical supplies. The board have complied with these directions, and intelligence has been already transmitted to them of the great efficacy of the lymph so sent.

"A large supply of lymph has been forwarded to Aden and to Scinde. The board have thus the satisfaction of returning the real boon of protection to that quarter of the globe whence the palliative measure of inoculation was first introduced into Europe.

"Possessing that valuable boon, the board regret that, according to accounts they have lately received, the practice of inoculation should still partially prevail in one part of the United Kingdom, viz., Ireland. On the other hand, it is encouraging to them to recur to the enlightened expressions used by the Lord Chief Justice of England on the illegality of the practice in this country, and they trust that the influence of so sound a judgment may be extended throughout her Majesty's dominions.

"We have, &c.,

"JOHN AYRTON PARIS, M.D.,
President of the Royal College of Physicians.

"EDWARD STANLEY,
President of the Royal College of Surgeons.

"JAMES ALDERSON, M.D.,
Senior Censor of the Royal College of Physicians.

"Countersigned by C. HUE, M.D.,
Registrar."

A CAUTION TO CHEMISTS.

[From the *Pharmaceutical Journal.*]

Several correspondents have applied to us recently, as well as on former occasions, for advice in reference to misunderstandings with persons introducing new articles, and furnishing the first order on sale or return, or other special conditions. It has sometimes occurred that the purchaser, having bought the goods under the impression that he was incurring no risk, finds, in the course of a few months, that the whole are on his hands, and that by not returning them before a particular day he has forfeited the privilege. We have known cases in which the orders have been almost forced upon the purchasers, or the goods sent without any positive order, and

yet it has been difficult to make a defence, for want of legal evidence of the real nature of the transaction.

The most recent cases referred to us are misunderstandings for want of a written agreement, comprising all the conditions. In one case the signature of a chemist was obtained on a blank order, under the pretence that the traveller would inquire whether his employers would send the goods on sale or return, the party refusing to take them on any other terms. Some goods were sent without this condition, and returned in consequence. A correspondence ensued, but the venders held the party to his agreement, not admitting his plea that the signature was given conditionally on a blank order, pending an inquiry. In another case a special condition was entered into by the traveller, but not written on the order. The condition being violated, the goods were returned. But a random shot from a lawyer brought down the victim, and the money was paid with costs to save further trouble.

Now, these misunderstandings and losses (of which the above are only a few instances by way of example) might easily be avoided by taking the precaution to place all the particulars of the agreement in writing, each party keeping a copy attested by an impartial witness. With some persons a word is as good as a bond ; in the case of others a bond is preferable. In dealing with strangers, it is better always to have a written agreement, and especially where the parties are strict disciplinarians in their method of transacting business.

For example, Messrs. Williams and Co., of 19, Broad-street-buildings, who have recently introduced some proprietary nostrums, have a notice on their order-paper, to the effect that goods are not sent on sale or return, and that the travellers have no authority to take orders on other conditions than those expressed on the face of the order. Now, in this case, reliance should not be placed on any conditions proposed or assented to by the traveller, unless written on the order, and signed by him in the presence of a witness. Those who neglect this precaution must be prepared for a shot in the course of three months. It is of course optional with persons in business to adopt the sharp or the mild practice, according to their taste or humour. Some find it policy to win the confidence and good opinion of their customers by civility and an accommodating disposition. Others act according to law, which is as the laws of the Medes and Persians, and insist upon having "the pound of flesh." In dealing with persons of this latter class, we advise our readers to be on their guard, and see that the "bond" is explicit and properly attested.

ATMOSPHERIC INFLUENCE ON VEGETATION.

Atmosphere supplies the vegetable creation with the principal part of its food ; plants extract inorganic substances from the ground, which are indispensable to bring them to maturity. The black and brown mould which is so abundant is the produce of decayed vegetables. When the autumnal leaves—the spoil of the summer—fall to the ground, and their vitality is gone, they enter into combination with the oxygen of the atmosphere, and convert it into an equal volume of carbonic acid gas, which consequently exists abundantly in every good soil, and is the most important part of the food of vegetables. This process is slow, and stops as soon as the air in the soil is exhausted; but the plough, by loosening the earth, and permitting the atmosphere to enter more freely, and penetrate deeper into the ground, accelerates the decomposition of the vegetable matter, and consequently the formation of carbonic acid. In loosening and refining the mould, the common earthworm is the fellow-labourer of man. It eats earth, and, after extracting the nutritious part, ejects the refuse, which is the finest soil, and may be seen lying in heaps at the mouth of its burrow. So instrumental is this reptile in preparing the grounds that it is said there is not a particle of the finer vegetable mould that has not passed through the intestines of the worm ; thus the most feeble of living creatures is employed by Providence to accomplish the most important ends. The food of the vegetable creation consists of carbon, hydrogen, nitrogen, and oxygen, all of which plants obtain entirely from the atmosphere, in the form of carbonic acid gas, water, and ammonia. They imbibe these three substances, and, after having decomposed them, they give back the oxygen to the air, and consolidate the carbon, water, and nitrogen into wood, leaves, flowers, fruit. When a seed is thrown into the ground, the vital principle is developed by heat and moisture, and part of the substance of the seed is formed into roots, which suck up water, mixed with carbonic acid, from the soil, decompose it, and consolidate the carbon. In this stage of their growth, plants derive their whole sustenance from the ground. As soon, however, as the sugar and mucilage of the seed appear above the ground, in the form of leaves or shoots, they absorb and decompose the carbonic acid of the atmosphere, retain the carbon for their food, and give out the oxygen in the day, and pure carbonic acid in the night. In proportion as plants grow they derive more of their food from the air and less from the soil, till their fruit is ripened, and then their whole nourishment is derived from the atmosphere. Trees are fed from the air, after their fruit is ripe, till their leaves fall ; annuals, till they die. Air-plants derive all their food from the atmosphere. In northern and mean latitudes winter is a kind of complete rest to the vegetable world ; and in tropical climates the vigour of vegetation is suspended during the dry, hot season, to be resumed at the return of the periodical rains. Almost all plants sleep during the night; some show it in their leaves, others in their blossom. The mimosa tribe not only close their leaves at night, but their foot-stalks droop ; in a clover-field not a leaf opens till after sunrise. The common daisy is a familiar instance of a sleeping flower : it shuts up its blossom in the evening, and opens its white and crimson-tipped star, the "day's eye," to meet the early beams of the morning sun ; and then, also, "winking Maybuds begin to ope their golden eyes." The crocus, tulip, convolvulus, and many others, close their blossoms at different hours towards evening, some to open them again, and others never. The condrille of the walls opens at eight in the morning, and closes for ever at four in the afternoon. Some plants seem to be wide awake all night, and to give out their perfume then only, or at nightfall. Many of the jessamines are most fragrant during the twilight ; the olea fragrans, the daphne odorata, and the night-stock reserve their sweetness for the midnight hour, and the night-flowering sirius turns night into day. It begins to expand its magnificent sweet-scented blossoms in the twilight, it is full-blown at midnight, and closes, never to open again, with the dawn of day.—*Mrs. Somerville.*

THE APOTHECARIES' COMPANY NONSUITED.

COUNTY COURT, WATFORD, MONDAY, MAY 14.

Before J. H. Koe, Esq., Q.C.

THE MASTERS, WARDENS, AND SOCIETY OF THE ART AND MYSTERY OF APOTHECARIES OF THE CITY OF LONDON v. E. H. C. KELLY, ESQ., M.D.—Counsel for the plaintiffs, Mr. Atkinson; solicitor, Mr. Rowell, of Rickmansworth. The defendant was represented by Mr. Frederick Day, of Hemel Hempstead, solicitor, and Mr. Frederick Asprey, of Furnival's-inn, London, solicitor. The case excited great interest in the town and neighbourhood, and the court was densely crowded during the trial; all the leading members of the medical profession in this part of the county appeared to be present.

This action was brought to recover a penalty of £20 for an alleged infringement of the 20th section of the Apothecaries' Act, the 53d Geo. III., c. 194.

Before the learned counsel opened the plaintiffs' case, several objections were taken on the part of the defendant to the cause proceeding. First, to the jurisdiction of the County Court in this particular case, on the ground that it was an action to recover a penalty, and the informer was entitled to half the amount in case of conviction, and, therefore, the County Court Act did not embrace this description of action. Secondly, that the action was not rightly brought, it being instituted in *tort*, which implies some act done in the nature of trespass, and such actions being brought to recover unliquidated damages for a personal wrong, whereas the present action was brought to recover a penalty of £20. As this was a certain sum, it was contended that the present case did not come under the description of actions called actions of *tort*. And, thirdly, that the plaintiffs did not disclose any ground of action for assuming that the defendant had done all that was charged against him, and even then that he would not be liable to the penalty in question. These points were very ably argued at great length on the defendant's behalf, and an appeal made to the learned judge to nonsuit the plaintiffs ; but, after hearing the counsel in reply, the judge declined to stop the case. Notes of the several objections were, however, taken by the judge, and the case proceeded.

The learned counsel, in his opening speech to the jury, stated that this was an action brought against the defendant, who was described as a gentleman residing at Pinner, of acknowledged ability in his profession, and duly qualified to practise as a physician and surgeon. Not the slightest imputation was attempted to be cast upon the defendant in his professional character ; but nevertheless the Apothecaries' Company have thought it their duty to bring forward the present case against the defendant, who has been practising as an apothecary without having obtained the required certificate, as directed by the act of Parliament. Mr. Atkinson then proceeded to describe the difference between the duties of a physician and surgeon, and those of an apothecary, and admitted that the defendant had a perfect right to practise as the former, but not in the latter character. He had, however, practised as an apothecary, and hence his liability to the penalty in question. Mr. A. then referred to the charge in question, and went on to state that the complaint in the present case was, that the defendant "had acted and practised as an apothecary (to wit) at Pinner, by then and there acting as such apothecary, in attending, advising, furnishing, and supplying medicines to and for the use of one James Hedges, and others," without having obtained such certificate as by the act is required. "Now," continued the learned counsel, "I shall prove, if I am properly instructed, that the duties of an apothecary are, to prepare with exactness, and to dispense, such medicines as may be directed for the sick by any physician lawfully licensed. While, therefore, the defendant confined his practice to prescribing, no charge could be made against him for a violation of the Apothecaries' Act; but I shall prove by the clearest evidence that in the present case the defendant has not only attended patients and prescribed for them, but likewise furnished them with medicines, and that, therefore, he is liable to the penalty now sought to be recovered." The learned counsel then called the following witnesses :—

Mary Leach said : I am a widow, and know Dr. Kelly, the defendant. He attended my husband several times before his death, which took place on the 26th of June last. The defendant said he would not pick my pocket, but would do all he could as a friend. He gave me something in bottles for his cough. He sent me four or five bottles. I have not paid the doctor anything.

Cross-examined : The medicines sent by the doctor were only for my husband's cough. I know Mr. Haynes, who has called upon me about this case. I do not know that he is the informer.

Thomas Graves examined: I am nephew to Mrs. Leach, the last witness. I have been to the defendant's house for medicines, and he gave me some medicine out of a bottle. I only went once for medicine for my master, who was ill about two months.

Cross-examined: I don't know what the medicine was that was given to me.

James Hedges said: I am a farmer, living at Pinner. I am a member of the "United Brethren Society," and have belonged to the club twenty years. I had a cold last November. I was not attended by the doctor at all. I went to the defendant's house, but did not see him. He is the doctor to our club. I have paid no money to the club.

Cross-examined: Mr. Kelly said, "I will give you something for your cold." I know Mr. Haynes: he has called on me about this case.

Thomas Tull examined: I am a shoemaker, residing at Pinner, and secretary to the "United Brethren Society." There is an agreement about a doctor in our club. (The subscription was here produced and read.) I had some conversation with the defendant last year. I said it was necessary to have a doctor in our club, and that he, the defendant, had been appointed by the members. He said he would prefer being paid a certain sum per year. We talked the matter over, and agreed to pay him 4s. per annum each member. I saw defendant again, and left a copy of our club-book with him. I paid the money for each member to the treasurer. I have not seen the defendant attend any case.

Cross-examined: I have not paid the defendant any money on account of the club. He has not supplied any of the members with medicines that I am aware of. I know Mr. Haynes, but cannot say whether he is the informer. I have seen him about this matter. I see him now in court. The witness was requested to point out Mr. Haynes in court, and he did so.

This closed the plaintiff's case.

It was then submitted on the part of the defendant that the plaintiffs had entirely failed in making out any case whatever to go to the jury; and, on the learned judge quite concurring in this opinion, the plaintiffs were nonsuited. Whilst the judge was making some observations on the vagueness of the evidence produced on the part of the plaintiffs, one of the jury stated that they were quite prepared to return a verdict for the defendant; but, no case having been made out for their consideration, a nonsuit was the consequence.

MISCELLANEA.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING MAY 31ST, 1849.

David Smith, of the city of New York, in the United States of America, lead-manufacturer, for certain new and useful improvements in the means of manufacturing certain articles in lead. Patent dated May 29th, 1849; six months.

Richard Edward Hodges, of Bycroft, in the county of Hereford, gentleman, for certain improvements in mechanical purchases, which are also applicable, in whole or in part, to projectiles. Patent dated May 29th, 1849; six months.

John Dugdale and Edward Birch, both of Manchester, in the county of Lancaster, tool and machine makers, for certain improvements in constructing and propelling ships or other vessels. Patent dated May 31st, 1849; six months.

PATENTS RECENTLY EXPIRED.

T. F. Bergin, Dublin, civil engineer, for certain improvements in the method of suspending and adjusting the bodies of railway and other carriages. Patent dated May 27th, 1835; expired May 27th, 1849.

J. G. Bodmer, Bolton-le-Moors, civil engineer, for certain improvements in machinery for preparing, roving, and spinning cotton and wool. Patent dated May 27th, 1835; expired May 27th, 1849.

J. Losh, Carlisle, gentleman, for an improvement in the surface or pattern roll of the machines used in printing calico and other goods, commonly called surface printing machines, and in the mode of working the said rolls. Patent dated May 30th, 1835; expired May 27th, 1849.

HEALTH OF LONDON DURING THE WEEK.—The 895 deaths registered in the week exhibit a satisfactory decrease of 68 on the weekly average of five springs. The mortality from the zymotic or epidemic class of diseases continues to fall, the deaths in last week having been 209—those in the preceding week 233; the average is 198. Scarlatina has now declined rather below the average, and numbers 29 fatal cases. Typhus, which during the previous 13 weeks ranged from 33 to 46, was fatal in the last week to only 23, an unusually small number for this disease, and hardly exceeding one half of the average. Small-pox, also, is fatal to few at the present time; the weekly numbers during last month were respectively 12, 6, 8, 6, whilst the average is 21. The mortality from hooping-cough declines, though it is still above the average. Measles appears on the increase, and has last week nearly doubled the average, which is 21 deaths. The deaths from diarrhœa and dysentery were 19; the average of the season is 14. Cholera is slightly increasing, for, though one death forms the weekly average of former springs, the fatal cases registered during the last four weeks have been 3, 1, 5, 9. Of the last nine cases five occurred in public institutions, namely, two in the Dreadnought Hospital, one in the Holborn union, one in the Chelsea, and another in the Battersea workhouse. Both bronchitis and pneumonia grow less fatal, though the former is still above the average, while the latter is below it. A woman in the Leather Market, sub-district, Bermondsey, died at 54 years of age of "bowel complaint and debility, hastened by want of sufficient nourishment, no application having been made to the parish authorities." A boy of two months, at Somers-town, was "found dead in bed, suffocated from inhaling impure air." A woman of 52 years died from "vomiting blood, caused by excitement." Inquests were held on the above three cases. A man of 36 years died "suddenly after illness, probably from intemperance," but the cause of death is not attested either by coroner or medical man. The mean reading of the barometer was above 30 in. on Monday, Tuesday, and Wednesday. The mean of the week was 29.978. The thermometer was highest on Thursday, when it reached 74°.9; the mean of the same day was 64°.3. The mean of the week was 60°.3. On Thursday the mean temperature was higher than the average of the same day in seven years by 7°.4, though it was below it on the first two days of the week. The mean of the week exceeded the average by 1.3.—"Registrar-General's Return."

SMITHFIELD MARKET.—The protracted inquiry of the parliamentary committee into the eligibility of Smithfield Market is about to be brought to a close. On the 4th inst., on its reassembling in committee-room No. 13, Mr. Mackinnon, the chairman, intimated that, after hearing one or two more witnesses in favour of the continuance of the market, the committee would be content to take as though given before them the evidence that was adduced before the House in session 1847 bearing on that part of the inquiry, and would then make their report. The last few sittings of the committee have been principally occupied with the evidence of some of the principal butchers, graziers, and salesmen of the metropolis and the market, who are in favour of the continuance of Smithfield, on account mainly of its central situation, and its proximity to their premises and slaughterhouses.

HYDROCHLORIC GAS.—For a considerable period this noxious vapour was one of the greatest nuisances to the manufacturer and to the neighbourhood, blighting vegetation for a great distance around the works. "At first," writes the justly celebrated author of the "Familiar Letters on Chemistry," "the profit upon the soda was so great that no one took the trouble to collect the muriatic acid; it ran to waste—it had no commercial value. A profitable application of it, however, was soon discovered." Yet for some years enormous sums were spent in erecting gigantic chimney-stacks, such as those of the Messrs. Tennant, near Glasgow, where one of the largest rears its head fully one hundred feet higher than the top of St. Paul's Cathedral. "Its occupation has gone" with the advance of chemical knowledge; and it now remains a huge monument to the ignorance of the past. In other cases the muriatic acid was let off into the common sewer, and glad were the manufacturers to get rid of their acrid and troublesome product in this quiet way. But, now that muriatic acid has entered into its proper chemical relation with the arts, it is as carefully preserved and retained as it was formerly dismissed. Various plans exist by means of which it is collected and reduced from the gaseous to the liquid form. The most common of these is, to conduct the vapours which rise from the decomposing salt into flues, which terminate at the bottom of a tower or chimney, filled with flints or coke. A number of minute jets of water play on the coke at the top of the chimney, and the fluid gradually filters down, meeting in its course the ascending noxious vapours. These become immediately condensed, and the liquid, percolating to the bottom, there enters a tunnel, and is conducted into a receptacle, now in the form of liquid hydrochloric or muriatic acid.—*Eclectic Review.*

THE USE OF THE ELECTRIC CLOCK FOR SCIENTIFIC OBSERVATIONS. — Amid the many practical advantages which are derived from the application of magnetic electricity to telegraphic purposes, attention must be drawn to the great importance of the use of the electric clock for scientific observations. Although the beautiful arrangements of Professor Wheatstone have excited much attention in this country—and some modifications of his plans been produced—we have not yet applied this means of registering the beat of the foot of Time, in its passage, to any useful end. In the United States, however, the electro-magnetic chronograph of Professor Locke, having been reported on by Professor Bache, superintendent of the coast survey, is now adopted by the Government; and the Congress have appropriated ten thousand dollars to Professor Locke for a clock upon his plan to be erected by him at the National Observatory at Washington. The report of Mr. Walker, Secretary of the Treasury, gives the best description of this clock; and we transfer it to our columns:—"It consists in printing instead of recording the dates of astronomical events on the running fillet of paper of Morse's 'Telegraph Register.' An astronomical clock of the most delicate construction has an apparatus attached to the arbor of the second's hand, so as to make and break the galvanic circuit every second. By putting it in connection with the telegraph line of Morse's at any place on the line, the paper is graduated automatically with the hours, minutes, and seconds. The rate of movement of the clock is not in the slightest degree affected by its action. The paper so graduated is called the 'Automatic Clock Register,' and has all the precision, for days or months in succession, of the most perfect astronomical clock. Each second consists of a line some nine tenths of an inch in length imprinted on the fillet of paper, with a blank space for the remainder of the second. The astronomer at any station on a line of several thousand miles in length may imprint on this register the date of any event by simply tapping, after the manner of playing upon a piano, upon a break circuit key. This imprints in the indented line a corresponding break circuit space. Two or three spaces may be printed in one second if desired. Two seconds of time is ample for the

equatorial interval of the wires of a transit instrument. The network of spider lines is divided into some nine or more tallies, or distinct groups of five wires each. All these tallies in the case of the transit of a star are imprinted on the register in the time occupied by the ordinary method for a single tally, to which a transit has been usually limited. The skill required for tapping on the key at the instant of the bisection of a star is easily acquired, and the accuracy of each imprint is much greater than that of a single record by the common method. The imprints furnish a perpetual record of the date of the event, and may be read off with great rapidity to the hundredth of a second by means of a graduated scale of the paper used for registering. This process has been employed for the first time in the coast survey operations; but it will be of great use for the general purposes of practical astronomy." Licutenant Maury, of the United States navy, says, in a communication to the "Athenæum," "The magnetic telegraph now extends through all the states of the union, except perhaps Arkansas, Texas, and one other frontier; so that a splendid field is presented for doing the world a service by connecting, for difference of longitude through means of magnetic telegraph and clock, all the principal points of this country with this observatory (Washington). In anticipation of such extension of the wires, I ordered an instrument for the purpose, and it has recently arrived. It is intended to determine latitude also, so that by its means and this clock I hope, during the year, to know pretty accurately the geographical position of Montreal, Boston, Chicago, St. Louis, New Orleans, &c., and their difference of longitude from this place, quite as correctly as the difference between Greenwich and Paris has been established by the usual method and after many years of observation."

Method of Soldering Cast Iron with Wrought Iron.—The following process has been recommended for this purpose:—First melt filings of soft cast iron with calcined borax in a crucible; then pulverize the black vitreous substance which is thereby produced, and sprinkle it over the parts which are intended to be united; after which heat the pieces of cast and wrought iron and weld them together on an anvil, using only gentle blows. This method is peculiarly applicable for the manufacture of iron articles which are intended to be made red hot, and are required to be impervious to fluids or liquids, as such a result cannot be obtained by simple fastening.—*Technologiste;* and *Newton's Journal*, May, 1849.

The Pulque of Mexico.—The maguey (American aloe)—Agave Americana—is cultivated over an extent of country embracing 50,000 square miles. In the city of Mexico alone the consumption of pulque amounts to the enormous quantity of eleven millions of gallons per annum, and a considerable revenue from its sale is derived by Government. The plant attains maturity in a period varying from eight to fourteen years, when it flowers; and it is during this stage of inflorescence only that the saccharine juice is extracted. The central stem which encloses the incipient flower is then cut off near the bottom, and a cavity or basin is discovered, over which the surrounding leaves are drawn close and tied. Into this reservoir the juice distils, which otherwise would have risen to nourish and support the flower. It is removed three or four times during the twenty-four hours, yielding a quantity of liquor varying from a quart to a gallon and a half. The juice is extracted by means of a syphon, made of a species of gourd called acojote, one end of which is placed in the liquor, the other in the mouth of the person, who, by suction, draws up the fluid into the pipe, and deposits it in the bowls he has with him for the purpose. It is then placed in earthen jars, and a little old pulque (madre de pulque) is added, when it soon ferments, and is immediately ready for use. The fermentation occupies two or three days, and, when it ceases, the pulque is in fine order. Old pulque has a slightly unpleasant odour; but when fresh is brisk and sparkling, and the most cooling, refreshing, and delicious drink that ever was invented for thirsty mortals.

Artificial Mahogany.—The following method of giving any species of wood of a close grain the appearance of mahogany in texture, density, and polish, is said to be practised in France with such success that the best judges are incapable of distinguishing between the imitation and mahogany:—The surface is first planed smooth, and the wood is then rubbed with a solution of nitrous acid. One ounce of dragon's blood is dissolved in nearly a pint of spirits of wine; this and one third of an ounce of carbonate of soda are then to be mixed together and filtered, and the liquid in this thin state is to be laid on with a soft brush. This process is to be repeated, and in a short interval afterwards the wood possesses the external appearance of mahogany. When the polish diminishes in brilliancy, it may be restored by the use of a little cold-drawn linseed oil.

The Earl of Rosse gave his third soirée as President of the Royal Society on Saturday, May 26. There were several models and inventions exhibited, the most remarkable amongst the latter being a machine for manufacturing printing types without fusing the metal and pouring it into moulds. The inventor, M. Petit, effects his process by the use of steel dies and matrices, which by means of powerful pressure impress the letters, &c., on copper fashioned into quadrangular strips of indefinite length wound round a cylinder. The hardness of ordinary copper over type metal is in the proportion of 100 to 1. A London firm employed to print stamps for the Government is in the habit of using raised copper surfaces for the purpose; no less than 125,000,000 impressions have been taken from one of their plates. The density of the copper used in the manufacture of type is considerably increased by the compression which it undergoes by the machinery of M. Petit. The machine produces thirty-two types per minute; and it would be difficult to exceed the typographic neatness of the character. Specimens of the type and printing were distributed amongst those present.—M. Niepce exhibited a drawing produced by the following ingenious process:—An engraving is placed in a box containing iodine at such a temperature that a small portion is vapourized. The ink of the engraving condenses a much greater proportion of the vapour than the mere blank paper; so that when after a few minutes the engraving is taken out, exposed a moment or two to the air, and then laid on a film or two of starch, part of the iodine becomes detached from the engraving, and is transferred to the film of starch, producing a very delicate and beautiful copy of the engraving. As may be supposed, there are many niceties required which M. Niepce only can practise with perfection. It is necessary to enclose the film of starch between two glass plates in order to preserve it.

Men now-a-days turn their attention to strange things; and we have on all sides projectors of the most remarkable variety. M. Henri Chevalier, we are coolly informed, is the author of an invention by which he can perfectly "tuer son monde." A mysteriously manufactured wire is by some secret process charged with electricity; and it is then projected, it may be, either across a regiment of soldiers or a flock of sheep, and at the will of the operator they are either killed or stunned. We cannot understand the principles of this invention, which does not appear to answer to any known law of electricity; but the "little apparatus attached to a little electrical machine by copper wires plunged into a liquid" is the secret of the inventor; and we suspect it will long remain so.

Among the most important investigations of our own time we must assign a prominent place to those connected with meteorology. We may reasonably expect within a comparatively short period to ascertain the laws by which atmospheric phenomena, hitherto regarded as the emblem of inconstancy, are regulated. Observations of the most accurate kind are now made at all the magnetic and astronomical observatories in every part of the world; and the reduction and full examination of these have been made by Professor Dove. In a series of memoirs presented to the Academy of Sciences at Berlin, this investigator has most industriously determined the progression of atmospheric temperature during an interval of 115 years—from 1729 to 1843. It is impossible for us to give any idea of the amount of labour of the most severe description which is bestowed on this examination,—of the great variety of interesting facts embraced in these memoirs. It must suffice to state that the gradual passage of the isothermal lines of January and July into one another exhibits over the century the utmost regularity.

TO CORRESPONDENTS.

"A Country Chemist."—1. We intend shortly to act on our correspondent's suggestion. 2. Only a very few copies are on hand: price one half crown per copy.

"Mr. Metcalf, Manchester," will receive a private communication.

"Brush."—Scheele's green is prepared as follows:—Saturate a solution of carbonate of potass with arsenious acid, aiding the operation by the application of heat. Add the liquid to a solution of sulphate of copper as long as a precipitate continues to form.

"W. X." (a subscriber from the commencement) is referred to Nos. 69, 70, 71, and 72 of the *Pharmaceutical Times*.

"Mr. Richard Thackwell."—Possibly not; but the matter is of no importance *now*.

"Mr. W. Taylor."—We have complied with your request.

"Z."—Our correspondent must properly authenticate his communication before we can venture to insert it.

"Mr. Wild, Lisson-grove."—We have not heard of the invention mentioned by our correspondent; and we fancy, moreover, that the propulsion of a passengers' train at the rate of 130 to 150 miles per hour would prove *rather* inconvenient to the passengers.

"Mr. Jamieson, Glasgow."—Madder lake is prepared as follows:—Take two parts of best madder and eight parts of cold water. Macerate the former in the latter for about fifteen to twenty minutes. Put the madder into a cloth, and squeeze it strongly. Repeat the same operation three times. Digest the madder now for three hours in a solution of one part of alum in twelve parts of water, at the heat of the water-bath. Filter the liquid off, and add to the filtrate gradually, and in small quantities at a time, carbonate of soda, until the whole of the lake is precipitated.

"A Chemist."—Your statement has been forwarded to the proper quarter.

"A. B. C."—We do not know yet. Perhaps next week.

"M. C. S." is referred to No. 140.

"Mr. D. Richards, Leeds."—Bronze powder is prepared as follows:—Take of verdigris, eight ounces; putty-powder, four ounces; borax and nitre, of each two ounces; bichloride of mercury, two drachms. Make into a paste with oil, and fuse the mass together.

"Pan, Babell."—We will endeavour to comply with our correspondent's request.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—June 9, 1849.